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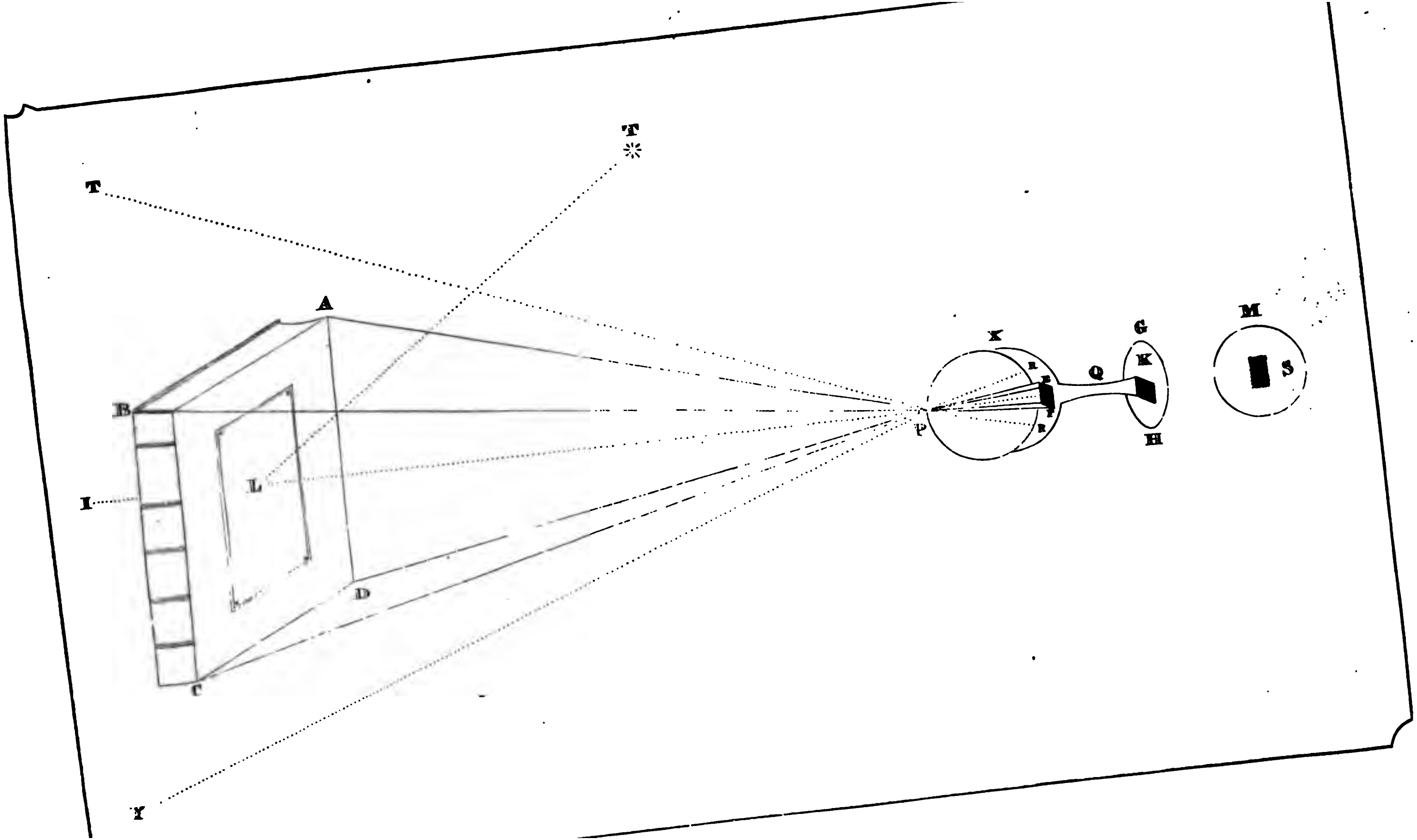
36.
645.

NATURAL PHILOSOPHY.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A THEORY
OF
NATURAL PHILOSOPHY,
ON
MECHANICAL PRINCIPLES,
DIVESTED OF ALL IMMATERIAL
CHYMICAL PROPERTIES,
SHOWING FOR THE FIRST TIME
THE
PHYSICAL CAUSE OF CONTINUOUS MOTION.

BY T. H. PASLEY.

> "He who does not understand MOTION is necessarily ignorant of all things."
> ARISTOTLE.

LONDON:
PUBLISHED BY WHITTAKER & Co., AVE-MARIA LANE.
1836.

645.

TO

JOHN LLOYD, Esq.

IN TESTIMONY

OF THE SINCEREST GRATITUDE

TO YOU,

AND TO THE MEMORY OF YOUR ESTIMABLE PARENTS,

FOR NUMBERLESS OBLIGATIONS NEVER TO BE FORGOTTEN,

THIS WORK IS DEDICATED,

BY YOUR FRIEND AND KINSMAN,

THE AUTHOR.

EXPLANATION OF THE PLATE IN FRONT, ILLUSTRATIVE OF THE THEORY OF PERCEPTION.

THE entire of the figure XP is designed to represent the External Organ of a Sense; in this instance the Eye, of which P is the Pupil, RR the Retina, Q the Optic Nerve. GH stands for the Brain, M the Mind, ABCD any external body to which the eye is directed.

The lines TY continuous to, meeting at P and continuous from P to RR, considered by Newton rays of light, are meant to show just so much of the whole of the *common sense-exciting medium* as is included between TPY RPR and by which the retina is impressed at the same time.

This medium is the same for all the Senses, it is quiescent, every where and at all times present, the pressure and changes of pressure on which make it the universal sense-acting cause.

The pressure is at the maximum on the retina when the perception is that of darkness.

A body we name luminous, as *T, when interposed in the axis of vision line PLI, or in the direction continuous with PL, as L*T, lessens the visual pressure on *TL LP, therefore on RR and makes it of that degree which causes the perception to be what is termed luminousness.

With the luminous body at T, Y or *T, and an opaque body as AC interposed in the axis line, the optic pressure, in this case, is less reduced than in the preceding, by which the perception is that we name colour.

EXPLANATION OF PLATE.

The perception, which is the sensation of luminousness, or of colour, accordingly as L is luminous or opaque, is, to us, apparently situated at its external cause L, which makes it be thought the external body is coloured and an object seen by the eyes. AC affects the pressure reduced generally by *T the Sun, or Flame, on the retina and on a portion of the retina the form of AC, as EF, which causes the brain to be affected by the optic nerve similarly, as at K, whence arises the sensation of colour, as S. So that M may be considered the whole sensation promoted by *T; and as consisting of the sensation of light including the sensation S of colour; which latter, from apparently belonging to AC, is conceived to be the colour of the opaque body to which the eye is, or at any time, directed.

AC cannot be similar in any respect to the sensation S of colour; and from AC being material, the sensation S mental, the external body is not coloured; and as colour only is visually perceived, the outward uncoloured body is invisible and the sensations, in every instance, is the sole object seen, that is, perceived.

By all the Senses it is the alike. The Mind only perceives: the Senses by their nerves but excite the brain; and the Object of Perception, whether of seeing, hearing, feeling, taste or smell, is but a Sensation. Hence, when it is imagined a body is coloured, hot, cold, noisy, flavoured or aromatic, the contrary is the fact, the whole being but sense-excited mental effects which indicate nothing of their external material causes, but, that they cannot by possibility be similar to sensations. Of external bodies we can know nothing; their existence we can only infer from the sensations they promote in the Mind.

☞ *The Reader is recommended to paint with vermilion the small figure* S *included in* M.

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ERRATA.

Page	VII	For	"organs of science," read *organs of sense.*
„	XIV	„	"make," read *can make.*
„	XLV	„	"endured," read, *endued.*
„	LXXXIII	„	"the wherein," read *wherein the.*
„	3	„	"species physical," read *species of physical.*
„	87	„	"assigned in," read *assigned us.*
„	„	„	"in this worlds," read *in this world.*
„	89	„	"organised system," read *organised systems.*
„	92	„	"axis in vision," read *axis of vision.*
„	129	„	"XBDFCS, read XBDYCS.
„	139	„	"which was so much," read *the part which was so much.*
„	192	„	"sides of pores," read *sides or pores.*
„	209	„	"sensible agency," read *but insensible agency.*

PREFACE.

DOUBTLESS it is the feeling and laudable ambition of every person to contribute somewhat to the common stock of knowledge. That all should according to capability, is imperative, from all drawing on it for information. Under this impression the present is my mite-offering.

Bold, without collegiate education—perhaps bold too much—but happily untrammelled by statute-learning, I have, after my own manner, fashioned an outline of Natural Philosophy, founded, I humbly conceive, on Natural Principles, which, and however novel the doctrine, is now adventurously submitted to the tribunal of public judgment, trusting most ardently, that when in more competent hands, it may in no small degree be the means, ere long, of promoting the best interests of Natural Philosophy.

Having sought most studiously, but in vain, among the various Systems of Philosophers, wherein consists the Simple Theory of Nature, it appeared there must be something fundamentally erroneous or all would be alike; natural principles being common, it is but reasonable to expect all deductions should be similar and tend to the same result. In the science of pounds, shillings and pence there is no difference, the standard of value is established and known by all. Whereas, in Philosophy, as if there were no standard of truth, diversity of opinion is too general even among the most scientifically learned; and on any thing like an indisputably fixed basis there seems to be nothing established. The Theory of Nature cannot be but simple, yet according to the most scientific illustrations there is nothing more complex. There is almost nothing of what is most generally received and considered established, excepting laws calculated from existing renewable effects, but what is disputed or disputable. In what is advanced as cause and causes there is the contrary of stability in every instance. Still most of all strange, is, the little adherence to first principles, these being not only overlooked in the illustration of phenomena but so generally perverted into their contrary, also, from the whole which are any way maintained being altogether inconsistent with the nature of that to which they are applied and from which they are said to be deduced, INERT MATTER. For while inertia is universally admitted to be essential to matter, not only is matter said to have several self-acting properties, but the mere principle itself, Inertia, which signifies nothing, is made an innate force. By which, instead of maintaining the true natural simple principles of unity of cause deducible from matter being inert, Modern Philosophy endows every atom in creation with the means of being cause, and not only so but of being each a twofold cause, by having the power to attract in one direction and repel in the contrary at the same time, yet still maintaining matter is naturally and essentially inert. And without any general individual cause for the whole, it maintains several general causes together with numerous partial causes for this and that phenomenon. Thus the Astronomer has his universal gravitation and central forces, the Chymist his universal attraction and repulsion, also sundry chymical causes of a different nature each for minor effects. This cannot be named simplicity nor the slightest approximation to unity of cause. Wherein then is there any true foundation for the superstructure of Modern Philosophy.

It cannot possibly be true that every molecule in Nature is endowed with ability to perform of itself a certain part, nor in reason that each can act in two opposite contrary modes; and it is repugnant to first principles that any molecule can of itself act essence of an atom. Can it make the atom act, and what can it effect on a like unalterable atom. May not an atom be acid and inert: and then of what use is acidity which is nothing communicable, the essence of an atom being identified with the substance. Under all these circumstances, and from acidity being an elementary quality that could not be generated by the accumulation of atoms in the bodily state, there appears no reason for considering acidity belongs to either matter or bodies.

The question is, how is it known by the Chymist there is acidity in either bodies or matter. The knowledge is but by the sense of taste. This, however, informs us nothing of matter or even bodies; by it we know only a sensation of flavour, which, from being but a mental sensible effect, is no criterion from which to decide on the nature of its material cause. On the contrary it determines that the cause cannot by any possibility be like the sensible effect in which the sensation consists. The effect or flavour is mental, the cause material, therefore the cause has nothing of the mental effect, flavour or acidity. This being the fact with respect to what we know by one sense, and all we know by the other senses being equally but sensations, the outward causes of our knowledge we cannot know, and of the whole we do know by our senses, nothing of the like is a property or quality of matter. Deducting then the whole of our sense-excited knowledge by bodies and leaving unalterable atoms to be impulsively acted on, there is nothing of the entire of Nature but what is composed of inert atoms, belonging to which there can be no cause of action physical or metaphysical.

Lastly, what species of cause is requisite that should be general and of an impulsive nature. Inert matter is no cause : cause not material is nothing. Yet that some universal cause exists is as evident as that the whole of Nature is in a state implying the presence of cause in every direction. Analogous to effect is cause, and from local change constituting all effect liable to matter, there is nothing to look to as cause but the general pressure, which, from being universal, it may in reason be assumed as constituting the Power of Nature.

After this mode of reasoning inductively from the nature of matter to that of cause, I concluded, that, the only correct basis on which a System of Natural Philosophy can be founded is that of the inertia of matter, and for cause the general pressure. The former is made evident by a knowledge of the nature and use of our Senses, whereby we learn to divest matter and bodies of all qualities and properties the like of the whole we know by the agency of these organs of information ; and that pressure is general there can be nothing more evident.

On these principles Inertia, and Physical Force resulting from the general pressure, I have attempted the illustration of some general phenomena under their respective heads, and, contrary to rule, introduced occasionally, as collateral proof, cases considered dissimilar, although there is similarity in all things in Nature, Cause, pressure, being the same for the production of every effect.

In frequent instances, the language made use of in what follows is stronger than warranted in theorising, which I trust will be received as mere inconsiderate wording. I advance nothing as the absolute fact, a point I am confident I have not and imagine none can arrive at in any instance. If I have led the way to the discovery of the Theory of Mechanical Nature, it is performing something in forwarding the great cause in which all are interested more or less. To witness the same ably advocated and made complete by hands more competent, will most amply reward, I will not say labours, but many years perseveringly devoted to this greatly edyfiing subject.

The *Theory and Principles of Perception*, I have exemplified in every manner I conceived necessary, according to my own ideas, in order to prove the necessity of abiding most strictly by them in philosophising on physical subjects, and to disabuse the minds of book-learned students of the prejudice of the learned against their application in physics, under the erroneous impression that nothing in the science of metaphysics has relation to even the *knowledge* of the performances of mechanical nature, and that by the Senses we have full knowledge of the materials of Nature; as if the whole of the sciences have not emanated from reasoning on the materials and performances of Nature, or, that in Nature there could be even two unconnected sciences. While metaphysics aim at that ever-to-be unsettled point, the final rest of human hope deduced from reason, which, most certainly, is widely separate from all physical disquisition, the relation the mind's knowledge maintains with physical nature is necessarily part of the Science of Physics and by which only we learn to distinguish what is physical from what is metaphysical; it being the fact we philosophise on the mind's knowledge, the whole of which is metaphysical, as if the whole were physical circumstances known immediately by the Senses or by the Mind. Whereas the Mind has no means of knowing any thing of material nature, its knowledge is wholly excited within itself by the instrumentality of the organs of sense and consists altogether in mere sensible effects.

To the learned the following Introduction may appear prolix; these persons I do not undertake to teach. By them I have been taught, and all are free to form their own opinion; mine I will freely change when its erroneousness has been proved. To the Amateur—like myself almost wholly a stranger to experimental performances, manipulations in the laboratory and the advantages to be derived from public lectures, but depending altogether on book-written opinions of the many—I conceived it due, to make known the offices of our Senses in a manner that should have the effect of convincing there is nothing known or can be known by them, the contrary being the impression from our infancy and maintained in every stage of subsequent education. For who does not think external bodies are seen by his eyes and that the whole are the same as his mental knowledge. This error being made evident, it cannot but be admitted we have been philosophising hitherto in a manner somewhat backwards, upon mental effects under the erroneous impression the whole are or belong to external bodies.

The Principles I have adopted are not mere nominals like Attraction and Repulsion. Inertia is undeniable and by all admitted : making it a resisting force is a perversion of common sense: not maintaining it most inflexibly in every physical instance has rendered Philosophy what it is, a mere compilation of isolated circumstances and assumed causes; whereas in the true sense and general application Philosophy is capable of being natural and perfect. Pressure is known and admitted; it is universal and indispensible not only to the performance but existence of the System. After deducting from externals the whole of the like of our sense-excited knowledge, it is obvious that all outward things are necessarily different from what we know; maintaining that inertia is essential to matter and pressure the only means of action, on these principles the following illustrations have been advanced, and maintained with much seeming consistency throughout, from which I am led to conclude the theory of Matter and Force here suggested and its exemplifications are not altogether erroneous.

If there be any thing of what is advanced in the subsequent sheets deserving the epithet, Original, it will be found in the Theory and Principles of Motion, which, whether *fact* or *fallacy*, by none can be denounced a plagiarism. I am fully aware the whole lies open to the too common objection, that, no general theory of Matter and Force can be relied on not mathematically and astronomically demonstrated. Of these sublime sciences I have assumed no knowledge for obvious reasons. Still, however necessary their application in proof, common understanding and a little learning are sufficient to direct rational investigation and establish any well founded refutation. This much with confidence may be said, that no Mathematician and Astronomer, with all his indisputable calculations, has, to this day, promulgated and exemplified a Theory of Nature on mechanical principles, or maintained in the proper sense and full extent the inert nature of matter. As by the measuring chain we make no discovery of the nature of the land or timber, by mathematical calculation, however just in itself, the nature of force remains still to be found out; and while from the most elaborate calculations the laws of planetary motion have been ascertained, still the cause of motion has hitherto been all guess-work, and that which has been hit upon is what the whole of matter declares a physical impossibility. In fact, with the aid of all the learning from all the sciences, the manner of accounting for planetary motion, from "impulse once impressed" and "gravitation," amounts to making all projectile motion be without cause; for if the equal of the assigned cause be deducted from the effect there is no cause for the remaining effect or motion,—still it is impossible effect can be greater than cause. From the present inconsistent condition of Philosophy it may also be said and without exaggerating, a little well directed reasoning can discover that which the Science of Mathematics is vainly applied to effect from not being legitimately deducible by the science. While, mathematically, the *laws* of Nature have been discovered, attraction, repulsion, gravitation and the central forces, as causes, are additions arbitrarily and erroneously assumed; the whole are in violation of the Inertia of Matter and each is equally absurd as impossible.

Should the Theory of Motion, now advanced, be found even an approximation to the natural fact, and as, *on the Cause of Motion being known and established depends the truth of our philosophy*, it may be somewhat interesting to know the steps by which the discovery, so far, has been effected, and will I trust, prove a useful lesson to those who tauntingly deny all right of idea and endeavour out of the beaten track, or not pursued by the legitimates of a College or Presidential Chair—not one of whom have ever had any correct idea of motion, or long before now the world would have been in possession of this MOST GRAND DESIDERATUM.

PREFACE.

For a number of years the discovery of a *perpetual motion* occupied my thoughts, and at every mechanical device I could imagine my leisure hours were employed. The pursuit brought me acquainted with my own errors. Nothing disheartened by numerous failures, I gave up all idea of employing mechanical means, but looked to the planets in search of the cause of these bodies performing perpetual motion: and being convinced that self-motion in a mass of inert matter is an absurdity, it appeared to me a matter of certainty, that, the planets must be involved in a medium on the pressure of which their motions depend. At the same time being engaged in the study of Murray's Chymistry, his neglect also of the principle of inertia induced the conclusion, that the whole must be contrary to the natural procedure. The subject of Expansion, I imagined, if correctly understood would afford means of setting the whole to rights—previously I had abandoned the whole doctrine of attraction and physical heat. I reasoned thus: a physical cause must enter a body to produce expansion; something must hinder this cause entering in the absence of fire: heat is not the cause of expansion: the hinderance against expansion must first be removed to let the expanding cause enter, which latter, when within the body, can effect but forcibly the separation of the atoms of the body. Here then is motion; and why not by the medium which keeps the planets in motion? A planet can only be pressed forward as are atoms during expansion. But then, the matter, the hinderance to the expanding cause entering the body, should, from being itself pressed against, effect expansion:—this led to the idea of minus-pressure matter, or, that of one kind of matter lessening pressure on some other. On which I concluded, that if a planet had one kind of matter on one side and a different on the opposite, planetary motion would be effected by the unequal pressure, thuswise promoted, of the medium of space. After ruminating on these ideas and applying the principles in illustration of recorded experimental trials, I found the whole such, as when matured, would account for phenomena generally, and hence the present Digest.

It is almost needless to mention, I felt ambitious to be the discoverer of the Cause of Motion if not capable of effecting a perpetual motion: still, by experience taught, I may be blind to some fundamental mistake which I am incapable of discovering. And from being unwilling to have the discovery known excepting *generally and at once*, I consulted none who could point out the possible fallacy. If the whole be a mistake, the Author has the Public to set him right, who will do so, each after his manner.—"Let them," however "chide me friendly and reprove me, but let not their *precious palms* break my head!"

To Micajah Brunel, Esq. I feel greatly indebted for much valuable information most obligingly bestowed on many former enquiries, troublesome no doubt to Mr. Brunel who knows so well the value of time: most particularly for his disinterested advice, to "*persevere.*" To Mr. Bacon, of Chatham Yard, I am no less indebted for his attention at all times to my suggestions, the errors of which he always discovered at a glance, and who, although not a Mathematician, is a real Mechanic.

There remains but to state, that, in my present isolated sojournment, having much leisure, the present work has been prepared for the press under several disadvantages; particularly the want of books on science to consult, and having only a few hastily scribbled common-place books from which to obtain subject matter and quote authorities. So that what is quoted may not be literally correct, as well as what is described of others in the plates may differ from the originals; but in no instance is any thing wilfully perverted. The whole is now before the Public, who will decide, for me if I deserve it, against me, if I deserve it.

Jersey, 20*th November*, 1835.

INTRODUCTION.

By Natural Philosophy is understood generally, a description of the Causes, Bodies and Circumstances constituting the phenomena of Physical Nature.—Comprising a history of the appearances, properties and qualities of Bodies and Matter under the various states and changes to which they are subject—upon the principles of Nature discoverable by the Senses and Reason—however from the fallibility of human judgment liable occasionally to misinterpretation, owing principally to cause being in no instance sensibly discoverable. Such, or nearly is the commonly maintained opinion as to the nature and import of Natural Philosophy.

The learned make no hesitation in philosophising on the foregoing conditions.—Nature, they say, consists of limited, although numerous phenomena, of laws few and general, and of matter most probably similar throughout; and from the greater portion of the whole being cognisable by the Senses there remains, it is said, little else for philosophic research than the discovery of wherein consists the *modus operandi* whereby the more recondite operations of

Nature are effected. These are the latest and most approved opinions on this highly interesting subject, the Philosophy of Physical Nature.

But while from the manifest simplicity of Nature it may with reason be infered the whole of matter is of the like substance, and hence the constancy of all emanating laws, still this informs us nothing of the agreement or disagreement there may be between our knowledge by external bodies, and the bodies themselves; but overlooks the possibility of outward bodies being vastly different from our knowledge—it does not inform us that the knowledge promoted by bodies may in nowise be similar to its material causes; and as we judge of outward things by what our mind knows, so if these and our knowledge be not the same, or the knowledge be something distinct and mental, the question naturally arises, on which is it we philosophise and reason in physical cases, the mind's knowledge or the bodies by which it is promoted. If material things be known as they are really, then is our philosophy a record of physical facts, and to the best of our understanding as they exist and take placein Nature. But if the knowledge external bodies promote, through the medium of the Senses and Brain, in the Mind, consist in mere mental effects, it is not the natural condition of bodies with which we are acquainted; and it must be contrary to the natural fact that bodies have qualities and appearances the like of our sense excited knowledge. If all we know by the Senses consist in Sensations, it is obvious externals are known to us only as being in existence and the means of promoting sensations, and what they really are, by sensations, we can never know; of this, however, we have certainty, they have nothing in common with sensations; notwithstanding from sensations it is unhesitatingly pronounced, not only what bodies are, but that they are similar in appearance, state and qualities to our knowledge which consists only in sensations. What can we judge from, it may be asked, but what we know. But knowledge by a body is as distinct from its outward cause as mind from matter; knowledge is nothing physical, therefore by it we can no more form a correct opinion of the actual state and appearance of material things, than by shadows of substance.

Taking the subject in the most limited point of view, let it be answered, is our knowledge by the visual sense, seeing the body to which the eyes are directed;—is the body made visible by the effect it promotes in the mind through the agency of the eyes, optic nerve and brain. If it be any ways visible, there is no sense excited effect or sensation necessary, nor is one conceivable as we have no knowledge of such effect and also of the body by which it is promoted at the same time. That the body is not visible is evident, from the whole we know by means of the seeing sense being colour; and as the means whereby we obtain the knowledge of colour, proves that colour is a sensation, so the sensation of colour is the only visible object. For as the body possesses nothing similar to the sensation it is devoid of colour, and to see it would be to behold an uncoloured body; but as this is both morally and physically impossible—all visual perceptions consisting in colour, and an uncoloured body being never seen,—neither is the body to which the eyes are directed, in any instance, an object of perception. And as by the visual sense nothing is known but sensations, so by the remaining senses the whole we know can be sensations only; and by the whole of our sensations, of their material outward causes we can know nothing, excepting, that as they are accessaries in promoting sensations such are in being, and in nowise resembling our knowledge by them.

Hence, to establish the fact that the whole we know and can be known by bodies and the senses is not of bodies but sensible effects, is indispensible towards philosophising with any degree of certainty. To be certain in this respect is imperative towards reasoning on physical cases on physical principles; otherwise it is evident the possibility of mistaking what are but metaphysical effects for physical causes.

If our knowledge be of bodies,—but which implies that the mind's knowledge is physical and sensations not mental—then light, heat, cold, colour, flavour, sound and odour, are not mental; but if it consist in sensations, nothing of the whole belongs to bodies or can be made to appertain to any thing material, yet the entire are imputed to matter and bodies. If it be the natural fact, if what bodies cause the mind to know, be but sensible effects while the contrary is imagined, it is on the objects constituting the camera of the mind we reason and philosophise, and not on physical circumstances; and in consequence, we account for physical change by means and causes not physical and altogether foreign to Physical Nature. Therefore, unless it be maintained to attribute nothing to matter and bodies the like of our knowledge by the senses, on plausibility only can the Philosopher's reasons and conclusions be founded, subject at all times to be superceded by greater plausibility the novelty of which is certain of gaining the ascendency however temporary.

The question has been repeatedly asked and agitated, namely, wherein consists the connection between the mind and matter, between the mind and external nature;—how is the correspondence maintained between the percipient principle and outward material things;—and however truly metaphysicians have decided, certain it is their conclusion has contributed little to the great aim and end of philosophic research, the grand discovery of the Theory and Principles of Nature; and solely in consequence of none maintaining practically what all admit as fundamental, that the mind alone perceives, and its perceptions consist of sensible effects only; which leaves all outward things unperceived, and deficient of every thing the like of our perceptions. Yet all, particularly the Chymical Philosopher, treat on physical phenomena by referring to the like, if not the same, of their sensations for physical cause; by which causes as numerous as sensations have been introduced into Science, and by those especially who are continually lauding the simplicity of Nature, unthinking that simplicity consists in unity of cause.

How the mind has its knowledge determines in what its knowledge consists, and proves it is not acquired by any act of its own, whereby it can take cognizance of outward things, but depends on the functions of the organ of Science, which, from exciting the brain originate sensible effects named Sensations, without which the mind knows nothing, and in which consists the whole it can be made to know immediately by the system of the Senses. The mind has no means of acquiring knowledge but by the instrumentality of the different organs of sense, otherwise those organs would be superfluous; and all by them it knows is but changes effected in its consciousness, from which it is utterly impossible to determine any thing of the bodies which are but remotely the sense acting means. Still all reason on unseen, unknown bodies, as if they and the mind's state of consciousness were one and the same. Thus, the sensation of colour is considered by all a coloured body looked at and seen, and the body which promotes the sensation of heat, one that is possessed of something similar to the sensation, as if sensations required their like for cause. Were this the fact, matter should be coloured, hot, acid and the like; it should be in essence as diversified, as sensations in appearance; it should be black, blue, yellow, red and white, hot, cold, noisy, aromatic and flavoured, and all in violation of the principle of simplicity. Whereas by means of the Senses we have the whole without matter being encumbered with any thing of the kind, which is in perfect accordance with the economy of Nature, made manifest in the miraculous system of mind affected by means of animal organisation.

Having the whole of our knowledge by the agency of the Senses and consisting in the mental result which follows exciting the brain, whence sensations are originated in the sensorium of which the mind is necessarily sensible, it is in vain every attempt at unravelling the physical system as long as what we know is reasoned on as physical cases and physical facts. If our sensations be deducted, what of their external causes remain known: there is nothing left on which to reason and philosophise but acting cause and unknown acted on substance independent of all sense excited information. Take away the sensation of colour, there is nothing seen; of heat, cold and hardness, there is nothing felt; and of sound, there is nothing heard nor to hear sound being nothing substantive. Take away the different sensations with which we are acquainted, there is nothing of body and the numerous bodies by which we are surrounded known to be in existence; neither is the existence of any thing known but inferentially from the changes promoted in the mind's sensibility. Wherefore, to have correct and fixed ideas of the infinite difference there exists between gross ponderable masses of matter and the knowledge we have by such, so as to reason on bodies in every instance independently of the mind's perceptions, in order that what is mental shall not be confounded with things gross and ponderable, is indispensible to the right understanding any physical phenomenon whatever.

That we have fallen into the error and mistaken the items of our knowledge for their remote causes is undeniable and on such an erroneous bias is the present day philosophy founded: so that in this "most of all enlightened age" there is much to set aside, unlearn and forget before a system of philophy can be composed and established on principles divested of all unreal causes, and founded on the broad and only true basis, *Inertia.*

All admit that perception,—which as a general term is expressive of the Mind being sensible of some species of effect having been excited in it by means of one or other of the Senses,—is a faculty possessed by the Mind; and from the Senses being but mere instruments for the purpose of acting on the brain, it is obviously a faculty of the Mind only. From which the question naturally follows, in what do the mind's perceptions consist; are not external bodies looked upon, seen, heard and felt, as is the general opinion; are they known instinctively by the mind from being present to the Senses; or, does the Mind wander abroad and then make known to itself their appearance, qualities and situation. The answer to which is, that, as previous sense action and excitement of the brain are indispensible, and as the resulting sensation is of necessity perceived, together with the fact that perception is not twofold, that is, the two objects are not at once perceived, the sensation and the outward body, it is clear the Mind does not perceive voluntarily, but only as it is excited, and that in the excitement it undergoes consists the object it perceives; which excitement, change of mind, or of the mind's consciousness we familiarly term a Sensation.

Although in sensations consist the first rudimental characters of all we know, the knowledge answers every purpose of its numerous outward causes being themselves known; and the design is so perfected in our organisation we cannot avoid identifying the mind's perception with the bodies by which they are promoted; we cannot at once divest ourselves of the accustomed opinion that the Senses perceive outward objects, and that the whole of external nature is precisely according to our knowledge. For the purposes of common life this relative knowledge of externals is all sufficient; it leads us to what we want and require and directs in all the concerns of society. But as philosophy is a history of physical facts and circumstances, in a word, of physical acts as they actually do take place in Nature, and although it is impossible to know what is the appearance of bodies, the like of sensations should not be looked upon as cause, quality or state of bodies, nor that be imputed to matter which by no possibility in reason it can possess. Therefore in philosophising all conventional opinion and language should be set aside, and all physical cases treated abstractedly of the entire we know by the offices of the Senses. And although by material agency our knowledge of Nature is originated, yet by it the whole we know is what takes place in the Mind, of the Nature of Mind, and is but the Mind itself excited into different states of consciousness or sensibility.

After these generals it is necessary to enter into particulars. Colour is a Sensation; the manner we have the knowledge of colour proves its mental nature. The optic nerve being acted on by something physical from without acts on and excites the brain; a perception or sensation in the Mind succeeds to which the name colour is applied. Hence as colour is a sensible mental effect, nothing but what is mental can have its similitude. Therefore external nature is as devoid of colour as of the sensation. This being the rational fact, of the real appearance of the bodies constituting the world we know nothing. What do we see or know visually of a distant Church when it is imagined the building is an object of eye sight, but colour, say white under a particularly defined form. White is known by the like means as red, yellow, blue, and colours generally, and is but a sensation. Beside white there is nothing seen or known, and were the sensation not excited we could have no visual knowledge of the Church being before they eyes. The Church to be visible should be seen as it really is, of no colour, but seeing an uncoloured object is the same as looking at and seeing nothing, in asmuch as seeing is but the being conscious of colour. Therefore the sensation white is the object of perception and the uncoloured building itself is invisible. The building is accessory to the optic impression on the return being productive of the sensation of white, still it is not even the immediate sense acting cause. And in consequence of the sensation seeming to be where the Church is and belonging to it, it is, that the perception, the sensation of white, is mistaken for the Church itself being seen.

Or, what do we know of a body even in this hand, when there is nothing from which to form an opinion but the sensations it promotes: it may be considered hot or cold, red or blue, highly flavoured and aromatic, but as the whole are items of the mind's knowledge and consist in sensations there can be nothing even similar belonging to the body. So that although directing our eyes to the body, touching, handling or otherways making use of it, sensations are all we know. Let these be deducted and of the body nor by it is anything known. Were the body a stone, as sensations are nothing stony we have no means whatever of knowing any thing of what even a stone really is although we can decompose, break, and make use of it in several serviceable ways. Still the whole we know by it is imagined to belong to it, and we describe its appearance, state and qualities in correspondence with our sense excited knowledge; but which, is not philosophising on physical principles. So that while in every instance the Experimenter accounts for physical change by referring to the like of his sensations for cause, it is impossible any of his illustrations can be true; yet throughout the entire of Experimental Philosophy there is nothing advanced as the rationale of a result but after this erroneous manner.

All are well aware of the magnifying effects of a double convex lens before the eye, yet who reflects on the phenomenon so as correctly to understand in what the magnified object consists. It is conceived the eye looks through the glass and sees the outward body magnified, but as the body remains unaltered, while that which is perceived is on an enlarged scale, it is evident the outward un-enlarged body is not the object perceived. The mental effect is the perceived object, the body itself is visually unknown. It is also imagined a rose in the hand is an object of sight and of a red colour, yet with stained glass before the eyes it is said to be seen blue, and made so by the glass. Now as there is no blue rose present, as the glass make no change of colour in the rose itself, and as the visual perception in every instance is equally but colour, in neither case of red or blue being perceived is the flower known, and the mental effect is the whole we know; to see the flower would be seeing an uncoloured rose. The stained glass does not affect the flower, it cannot make that blue which is not itself blue, it only alters the visual pressure on the sense and thereby causes the Sensation to be that of blue, which without the glass being interposed would be of red. What may be the actual appearance of the rose—according to human ideas of appearance—

is impossible under our present system of organisation ever to know or imagine.

As to the "Evidence of the Senses," on the supposed infallibility of which so much dependence is placed in determining the nature and appearance of externals, the natural fact is, the Senses afford no evidence whatever of bodies nor convey any to the Mind. All evidence is mental, originated in, located to and of the Nature of the Mind itself; it consists in mental consciousness differently excited, and is no evidence of any thing not in and of the Mind, therefore is none of physical cause and physical effect. What is the evidence of the Senses, when, "all is yellow to the jaundiced eye," while denied at the same time that all bodies are yellow, and when another person says he sees the same body red, yellow or blue, according to the medium between it and his eyes. Jaundiced eyes, stained glass nor the atmosphere can alter the real appearance of bodies; the whole cannot make that be yellow, red or blue, to which colour is as foreign as thought and sensibility. The sensation of colour is the perception known; and by this "indisputable evidence of the Senses" there is nothing known. Had we prismatic eyes or the ability to alter the shape of our eyes at will so as to make them correspond with the forms of artificial lenses, we could at pleasure have all our visual perceptions fringed with colours, magnified, diminished or multiplied as by means of vitreous lenses ; and with the same body before the eyes the object of perception could be made different in both colour and size from what it is with our eyes as at present. From which it is evident that as the object perceived is ever varying our perceptions afford no evidence of the external body. In both colour and size, and by the same body before the eyes, is the perception changeable. The Baloon which at the ground is said, from the indisputable evidence of the seeing sense, to be seen all blue, is seen white on high, all black when at the highest, and when it returns to the ground it is seen again all blue as at first; which then is it, blue, white or black, and if either, what changed the blue to white, and the white to black. But as the Baloon is as at first, unchanged, it is the changeable sensation of colour, not the outward body is the object seen, that is, perceived by the Mind. Colour is actually changed, but only in alteration of the Sensation, and change of size is but alteration of the idea we have by the Sensation. During the ascent the Baloon is said to be of a different size continually, yet the body remains of unaltered size and it could not be altered by eye-sight. Hence something else than the Baloon is the object perceived, which is the mental effect, leaving the outward object wholly unseen. These instances rationally considered and familiar to all, show the fallacy of the evidence of sense doctrine, which bestows on the lenses and nerves of a sense the faculty of looking through portions of space by the eye-balls out of their sockets, and on bodies the like of sensations; and notwithstanding this is the fact all Philosophers appeal to this evidence in accounting for physical circumstances, most particularly in cases wherein physical change is said to be caused by heat, cold, light and acidity; and the mistaken application is common to the whole of our Sensations.

That the object imagined seen by the eyes is nothing else than the effect in the mind—without denying the presence of an external body as the promoting means in all cases of perception, but only rejecting its visibility and erroneously imputed qualities—is peculiarly made manifest in the instance of the supposed image of the face on a looking glass, wherein the object of imagined eye-sight is not attached, even apparently, to any outward body, but is, as it were, situated in the air in shape and appearance of an unembodied moveable spectre, and far beyond the mirror where it is evident there is nothing of the kind. Under such circumstances there needs no hesitation in concluding the image or object perceived is altogether in the Mind, and before the face only apparently. That such is the fact, is also proveable by "the Moon's image shining on the water," and not on but 240000 miles beneath the surface although the water may be but an inch in depth; and not one image but at the same time 240000 were there as many Spectators. For as no two point to the same spot where, by "the testimony of their senses they see the image," if there be one there are as many as the number of Spectators, and as many more as that number increases. If but one which is it, the whole being there upon equal evidence. The fact however is, there is no outward image. Were there one or ten millions they would be invisible, and recognised only as would be as many floating oranges by the sensation of colour promoted by each. In the sensible effect consists the perceived image, which to each Spectator seems outwardly situated. Hence it is that but one is known to each Observer, and that no one knows that which another says his eyes see and to which he thinks he points. The visual continuity being changeable from one part to another on the surface of the water as the

Spectator changes his situation, causes the mental image, apparently on the water, to appear as if walking with the walker.

As to seeing outward bodies by means of their images being formed on the retina, by image making reflected rays, nothing can be more unreasonable. In the first place it involves the denial of seeing the body itself by being acquainted with only its image. Seeing a person by knowing there is an image on the retina behind the eye, is somewhat like looking directly at one's own back, or, as looking forward at a portrait which makes the original, at perhaps the antipodes, be seen; and is little short of hearing a man's voice by means of a post letter. An image on the retina cannot make itself seen by the Eye or Mind, much less contribute to making an external body be seen: so that by this Theory if any thing be established it is, that seeing is not by the eyes discovering any outward body or the image would be useless; and seeing the image leaves the body unseen or each would be separately distinguishable. In the next place, as to bodies reflecting image-making rays, it should have been stated by the Theorist wherein consists the reflecting ability of a body lying on the ground, at rest, and formed altogether of inert atoms: what means can it possibly have of reflecting from its surface rays of any kind: neither could rays acquire renewed impulse, as their stated novel direction implies, from a body not in motion: the reply is, none whatever. Of the reflecting power attributed to bodies, particularly such as are highly polished, there is nothing to say but that the principle is most unwarrantedly assumed. Reflexion implies an impelling reflecting cause. There can be no motion without impulse or else matter is not naturally inert and motion is natural to matter, but which would be a natural and universal hinderance to rest, a state in which bodies do exist unless impulsively acted on; and as that which impels must either follow after or press against the impelled body the whole of the continuance of the effect, reflexion by a body at rest is an absurdity and leaves the rays to reflect themselves; but as inert atomic matter cannot impel itself neither is there any reflexion of rays. Lastly, how is it possible, were rays reflected, that, of the whole from the entire surface of a body, a mere eye full of rays could arrange themselves on the retina, and there, on an almost mathematical point, compose a miniature likeness of the reflecting surface. Rays are said to consist of atoms, hence the image must be a species of mosaic composition. Wherein lies the intelligence that affects the arrangement. Of the face full of rays reflected to a mirror, thence back to the Spectator's eye, thence through the less than pin-hole pupil to the retina; how these few influent intermixed rays are to form themselves on the retina so as to compose in miniature an image or likeness of so large and differently featured an object as the face defies conception. Less than a pin's head surface is the size of the said image and formed contrary to the "Optic Theory" which assigns different refrangibility to rays, while to form an image of the reflecting body the most and least refrangible rays must be side by side occasionally: and how the image is seen or what its use nobody knows. Still more strange it is that an image should be formed by influent rays, which image might be of a body of a square or triangle form or that of a line, and the rays passing through the spherical lenses of the eye the mathematical demonstration of which determines that the focal spectrum can be no other than circular. As well might we look for the shape of the Cloud in the rain-mark on the ground as that of an external body on the retina from promiscuous, influent, reflected, converged, diverged and refracted rays of light. If rays were reflected from the face they must cover the entire surface of the Mirror, for as the face is moved the image seems on every part: how the much larger image on the glass could thuswise make an infinitely smaller on the retina is inconceivable; and the difficulty is increased by there being as many images as pieces or planes if we break the glass. Again how is it the image on the unbroken mirror is not distorted in feature and its rays intermixed during the most rapid motions of the head, a circumstance as impossible by image making reflected rays, as portrait painting by strokes of the brush from right to left and left to right. The fact however is, there is no reflection of rays; there are no rays of light or vision any more than rays of air or wind. Vision is promoted by a quiescent medium which is at all times present; the maximum of pressure of which on the retina is productive of the sensation of darkness—if darkness may be considered other than a state of mind in the absence of all visual sensation—and as minus pressure means, such as the sun, flame and bodies said to be luminous intervene, the optic pressure becomes lessened and the sensation named light or luminousness succeeds; so when an opaque body intervenes between the eye and "luminous" body the sensation is that of colour; and from the sensation being seemingly belonging to the intervening opaque body it is to us the colour of that body and to our imagination the body itself seen.

The great Lord Bacon most strongly recommends torturing Nature out of her secrets by means of Experiment. He forgot there is no lordly mode of making the dumb speak any more than of discovering a royal road to learning; like some who interpret, "harmony of the Spheres," the like of music by wind instruments, he gives "the voice of Nature" the interpretation, speech, and of course conformable to every language. Still the language of Nature is unintelligible to even the learned or there would be no disagreement in accounting for natural effects and results. Then, what does Experiment discover of the natural procedure in any instance; it never discloses cause; any mere nominal cause may be assumed. Experiment only proves that the result is according to anticipation, the contrary, or something unexpected. Nature is silent as death, hence human opinion is ever varying the same experimental result being differently understood and frequently by the same Operator interpreted different ways. Although Nature in every instance is the performer, Man but her Assistant, she is mute as to cause, and leaves it a matter of guess work to those who reason on bodies as if they were similar to sensations and on inertia as power. The truth then is, it is not Nature is tortured but human imagination and the result is, Philosophy not Natural.

The delicate experiment of the dissected eye, is said to prove most incontrovertibly the truth of the image making Theory; or, that an image is formed by rays of light on the retina of which the Mind becomes informed by the Sense, that is, the optic nerve, and by this means the external body is seen. To say Nature has been tortured out of this in formation and made to disclose her secrets, is little short of *scandalum magnatum*, which nothing but a *noli procequi* from the judgment seat of common sense should prevent being avenged by the whole world, because the false interpretation of this most refined experiment has misled the greatest Philosophers, given a specious reality to what is but fancy of imagination, and established a Theory founded on the grossest mistakes. The globule of aqueous humour obtained by the dissection, is similar to a glass globe of water common on the window shelves of shops, on which it is imagined images of street passengers are formed by rays of light. In proof there is no image, let the globe be looked on at the street side, there is no image seen, but were a wafer there it would be seen—using the popular style—and from every side no matter where placed. Besides, what is to stop the rays after passing through one side of the globe also the water and make them swarm, as it were, into an image. The rationale is, the image is the mental effect, the globe its apparent place. So it is with the globule of aqueous humour of the dissected ox's eye, there is no image on it, nor on the retine of any eye; and the epigram of the erroneous interpretation is, that so far from an image being seen the ox's eye itself is not an object of sight, it is not visible, nothing is known but the perception it promotes. The case is similar to that of the spectacled Sarbonne to determine experimentally, by torturing Nature, the momentum of rays of light; in which the silence of Nature pronounced in the language of truth, no momentum—because there are no rays, light being but a mental effect; the contrary is the radiation of misconception. To force reason to concur with the Theory of reflected image-making rays and the idea of torturing Nature by mere manipulation out of the knowledge of cause, together with the host of wonders imputed to the nonentity physical light, as natural facts mathematically demonstrated and according with the evidence of the Senses, requires a strong philosophic faith, a Newtonian and Baconian bordering on an Athenasian faith.

Here it might probably be asked, are the most highly learned ignorant of the fact; are they in error and misled by mere appearances. Can the Teachers of the World be uninformed, were it true, that the whole of Nature is excluded from human observation; that our Eyes see nothing, our Ears hear nothing; that bodies are neither coloured, luminous, sonorous, hot, cold nor acid and that sensations are the whole we perceive. Can Philosophers inculcate false philosophy. Is not the philosophy of Newton, mathematically proved by himself, that of general Nature. Is the universal opinion of mankind wrong which maintains that Man sees his brother Man when face to face. Can that be untrue which has the assent of the whole world. Can it be likely, that, directed by our Eyes and Ears through a world of obstacles with safety they neither see nor hear out of them, and that all things around us are invisible although we know the whole by looking at them. In a word, are our Senses by which alone we know how to obtain food, clothing and employment, that fire is hot, ice cold, and the light from the Sun turns darkness into day, given us by God himself in his abundant goodness to his Creatures for the conservation of life and improvement of our minds, but so many sources of deception. Is it possible the Senses are added to the frame to mislead the understanding and keep it the whole of life wandering as it were blindfold in one continued maze of error ?

Such objections will naturally occur to those whose philosophy has been formed for them and based on the evidence of the Senses. The reply to which is simply this: Philosophers themselves have their errors and prejudices and none are prone to think their judgment erroneous; still they have their bigotry of opinion as well as the unlearned and when most correct in Theory are frequently incorrect in its application, which will be most fully made appear a few pages hence. They, like others, too frequently make illustration mathematically demonstrated stand for physical proof. It was never designed externals should be visible, that the Eyes should see and Ears hear, it is our own mistake in thinking otherwise. The design is all-sufficient and faultless; that it is so is manifested in our imagining all things are visible; and how this is so is in our power to discover by making ourselves acquainted with the nature and functions of our Senses. Nor does our knowledge, such as it is, lessen its utility in supplying our wants both of body and mind. The natural fact is unalterable and the prescribed means all our condition requires. It is possible all mankind may be in error in some things; every new discovery and improvement indicate former errors of judgment. So little in general do men trouble themselves beyond their worldly interests that few, comparatively know any thing of the system of their own organisation particularly that of their Senses. All imagine their eye balls see outward bodies, that sound is something in the air heard by their Ears, that bodies are coloured, fire hot, ice cold, and vinegar sour, whereas the contrary is the fact in every instance, nor could qualities like these be either made known to us by the Senses or of any service whatever to inert matter. The functions of the Senses are ill understood or their mental results would be more correctly appreciated. Because by means of the external organs our perceptions are excited, it is imagined each is possessed of a perceiving faculty and that what constitutes the mind's knowledge are qualities, states and properties of things outside the Mind, nothing of which is the natural fact although considered such by mankind generally. All being similarly organised and what is excited in the Mind considered in the same light by all, so from all being of one mind in these respects no enquiry is made as to the nature and offices of the Senses or wherein consist the mind's perceptions. The Senses do not deceive, it is the uncultivated understanding. The whole is as it should be whatever may be human opinion. Excepting human conduct and human opinion every thing is right. Even opinion, however erroneous, is right to the individual: to him the contrary of what he thinks right is wrong, and he cannot maintain the two opposite opinions. Every Man's opinion is truth to himself until convinced to the contrary. Habituated to a certain mode of thinking without enquiry popular ideas are maintained in philosophy, which, when correctly investigated and traced to their origin, cannot fail to convince they inform us of metaphysical effects and nothing whatever of physical facts. All deception lies in mistaking the designs of Providence in the plan and the procedure of Nature in its execution. But imagine as we may the fact is still the same, in some degree comprehensible, and to which all will bend eventually who investigate the case correctly, and whose pursuits in the great expanse of Science has in view the laudable discovery of the Theory and Principles of Nature.

The great error lies with Philosophers themselves, who admit the principles of perception but consider them inapplicable to the illustration of physical phenomena and philosophise on the popular notion, that, what the Mind knows is known by the Senses, and, that the knowledge of externals is immediate. By which the philosophy of the Age, instead of being that of Nature, is little better than the philosophy of the uncultivated Artizan; inasmuch as both adopt the evidence of sense doctrine which adopts metaphysical causes, and in all experimental tryals assume a procedure contrary to that which is true and natural. This the Metaphysician will readily admit in granting that the Mind, not the Senses, perceives, that it has nothing to perceive but sensations, and that all externals are wholly devoid of the like of the mind's perceptions. Why philosophy should be conducted on contrary principles is incomprehensible; why it should maintain that heat, cold, light, acidity and such like are physical is inconceiveable. On those who teach and prescribe what should and should not be received as natural facts, rests the responsibility of propagating error and inculcating false opinions of the general procedure, to the perversion of philosophy from beginning to end and hindrance against what is true and natural being discovered or even sought after.

I shall now quote the recorded opinions of some of the most learned Philosophers of all ages, and leave it to the commonest understanding to decide, whether it be reasoning philosophically and according to their own admitted principles and correct conclusion, that, all knowledge is mental and bodies are nothing similar, their philosophising on the popular contrary notion. But first the popular opinion requires investigation by reason of its numerous errors and general prevalence. To enquire into it is necessary towards exposing its erroneous foundation; for the purpose also of undermining deeply rooted prejudices in favour of long established opinions sanctioned by the highest Authorities in Science; and, in order to prepare the Mind for the reception of new truths opposed to what, for centuries, have been supported by the assent of the whole of the enlightened portion of mankind.

The popular opinion or theory is founded on the erroneous basis of the Senses being possessed each of the faculty of perceiving outward things. It assumes that the Eyes see, the Ears hear, the Hand feels; that seeing is an act of the Eyes, hearing of the Ears; that all we know is known immediately by these organs; and, that our knowledge is of external bodies, their appearances, physical qualities and states. But let it be answered, with respect to the visual sense,—which is applicable to the whole of these mere instruments of mental excitement,—wherein consists the seeing or looking-out faculty of the eyes; of the lenses of which the eyes are constituted; of the mere eye-balls; of the optic nerve, or of the whole together naturally connected, when if only the optic nerve be injured or decayed, or although perfectly sane, but detached from the brain and the eyes remaining perfectly healthy, there is no seeing, nothing is seen by the eyes. What is this so named far-seeing far-extending faculty, seeing, imputed to the eyes, that extends through the Atmosphere, beyond its limits through space to the remotest known Star, through bodies as dense as glass and rock crystal, but which cannot see through a leaf of paper, the shallowest water a little clouded nor even the air during a fog. Why does not this power of eyesight assisted, as is maintained by rays of light, see the Stars at day time; and why, if the eyes see, is it necessary they should be filled with rays. As well might it be said Spectacles see as the eyes; without them the aged cannot see, yet Spectacles neither see, make the eyes see nor confer sight on the eye-balls; like the lenses of a Telescope the eyes are but mere instruments in promoting sensations visually excited. After a manner they regulate the visual pressure on the retina for the purpose of promoting distinct vision. Without the assistance of the eyes colour may be perceived were the optic nerve impressed by a blow or by a probe, but then the perception is of light or colour undefined and unproductive of the idea of form; it is as when the eyes are directed to a cloudless sky or highly ignited furnace. The eyes are of service in like manner as the lenses of the Telescope and possessed of as little sight; they constitute they eye and object glasses of the optic sense, and like vitreous lenses cause the part of the retina affected by means of the body to which the eye is directed to be of the shape of so much of the surface of the body as is facing the eyes. So far from seeing being by the eyes looking on externals, not only is the sensation of colour the object of perception in every instance, but the precedure by which it is excited does not even commence with the percipient principle, the mind: it commences outside of us by the sense acting cause affecting the retina or optic nerve, which promotes excitement of the brain, whence follows the sensible effect colour imagined to be the external body seen by the eyes. Throughout the whole proceeding there is nothing in support of the universal opinion that externals are seen by the eyes. We turn our eyes in the direction of a body, not to look on it but for the like purpose as the Astronomer turns the telescopic tube to face a Star, in order that by the outward body or Star the visual pressure of the connecting medium may affect the retina accordingly as it is affected by the body; then, as the resulting sensible effect seems to belong to the body the latter is considered an outward object or the Star seen by by the Eyes.

It may be objected, that, if the sensible effect were the object known and promoted by change of pressure on the retina, there should be two such effects at the same time, one by means of the retina of each eye from both being equally impressed, as is conceived by "seeing" equally the same object by either eye singly. The like objection has been raised against the image system. It has been asked, if the image on the retina be known to the Mind, why does the Mind know but one image although each retina possesses an image. The fact is there are two sensations excited in every instance by means of the two eyes; which is made manifest in the sensation by one eye appearing outside of us to be in a different place from the sensation by the other; for if we shut and open our eyes one after the other, the object, that is, the sensation of colour seems to jump about from place to place. It is apparently in the axis of vision line, extended outwardly, of each eye, and with both eyes open the two sensations are situated apparently at the body, which has the effect of making us imagine there is but one. There are even more than two sensations at the same time promoted by the same body and the feeling sense occasionally, as when the compressed fingers are passed over a pea: by the visual nerves and naked eyes there are only two, but with the aid of a multiplying glass several sensations are excited and visually perceived at once in consequence of the retina being affected similarly on different parts at the same time.

In consequence of the idea of form being always the same from the same promoting circumstances, it might be supposed we have a perfect knowledge of the shape of an outward body: but what agreement can there be between body and idea. Of the body being in motion we have our knowledge by reason of the impression or visual pressure being transferred successively from part to part on the retina, which causes the sensation to seem as if in a moving state before the face. In these particulars, form and motion—if form be limited to outline—it may be imagined the Mind's knowledge agrees with the physical fact. In this light form is not known as a sensation, but like motion is the idea arising from one. After all, form and motion are mere abstract ideas that inform us nothing immediately of body, and when applied to unknown material things may be in nowise demonstrable and but inferential ideal knowledge.

The popular theory is included in the Newtonian; the latter is more scientific; each makes the other more complex and inconsistent. The Newtonian maintains seeing is an act of the eyes, also by means of images behind the eyes; and both, that the eyes cannot see unless filled with rays of light. Hence in every point of view it is obvious the popular is not the natural theory of vision, and but a mode of thinking without enquiry. It explains nothing consistently nor in conformity with the functions of the Senses; the whole is assumed and contrary to reason and fact. It attributes to bodies what they have not and makes the philosophy of Light and Vision an ephemeral structure founded on false causes, therefore should no longer be maintained in physical philosophy.

In the preceding references to the popular theory the visual sense only has been noticed; in a general way however what has been said applies to all the Senses. By the whole of the Senses nothing is known bnt Sensations, therefore nothing similar to what we know as objects of hearing, feeling, taste and smell, belong to their outward causes. Each will be treated on in taking a cursory view of the physiology and functions of the organs of Sense, wherein the misapplication of our Sensations in physical illustrations will more fully be made appear.

Next to the popular opinion is that of the justly celebrated Doctor Reid, but which is nothing nearer the truth. It cannot however fail of exciting surprise from the conclusion the Doctor so abruptly arrives at being unwarranted by the premises laid down by himself.

The learned Doctor admits that in all instances of visual perception a sensation is excited in the Mind, and that without one there can be nothing perceived. The sensation, he is fully aware, must have its use; at the same time being strongly persuaded externals are visible;—so perfectly do sensations answer every purpose of their outward causes being known,—and from being certain the sensation and its cause are not known separately so as to make the perception twofold, he concludes, the external body is made visible by the sensation. He says, *in the sensation consists the means employed by Nature whereby we see the external body.* In reply it may confidently be stated the sensation is the perception and nothing of the body is seen or known: nor is there any reason for imagining an effect in the Mind makes known any thing beyond the mere mental effect. There is no immediate connection between the sensation and outward body, nor, in contradiction to Newton, is there any "reflex act of the Mind" capable of bringing the outward body under the immediate cognisance of the percipient principle. What is a "reflex act" but one of memory, a mere reminiscence of former sense excited knowledge. Besides, there is only colour known, which from being but a sensation, the sensation is evidently the object perceived and the body is not seen. The mistake arises from the force of preconceived opinion which makes reason itself give way to habitude; the corrective against which lies in a knowledge of the functions of those organs by which alone any thing is known. It would be a complex round-about mode of informing the mind, that of making sensations of but secondary use, subservient to the acquiring immediate knowledge of remote bodies; why not see the bodies at once and have no sensation; but as sensations are the mind itself wrought into knowledge by the changes its consciousness has undergone there can be no doubt that in them only consist its perceptions, And as in sensations we have all requisite knowledge of externals there is no necessity for knowing the bodies themselves. A sensation must be known; when visually promoted colour only is known. Were the body seen the sensation would be superfluous; and from the uncoloured body being unlike the sensation we are certain it remains unknown. Hence it is clear, the use of the sensation is not to make the body be seen; therefore the theory of seeing outward things by means of sensations is altogether untenable.

ARISTOTLE taught, that true philosophy has only matter of intelligence for its subject. For as the knowledge of externals is not immediate nor acquired by the mind acting voluntarily, but in consequence of the mind being excited by the Senses, so all we can know, reason and reflect on is what is thus originated within ourselves, which from being necessarily intellectual is not the knowledge of any thing material. All we know is by the Senses, and as these cannot receive material objects themselves *they receive their species* as wax receives the form only of the seal. And as perception is only by and in the mind, the mind has nothing to perceive but sensations, which from being immaterial have not even the semblance of the bodies by which they are caused.

PLATO maintained, that the Mind in perceiving, is like a person in a dark cave who sees not external bodies but only their shadows on the walls and ceiling within, by means of a small hole in front through which light enters and that the sensations in which our perceptions consist can reside in the Mind only, yet we connect them with extension, solidity and figure, and imagine that colour is something spread over the surfaces of bodies.

MALEBRANCHE says, externals themselves are not perceived. It is a truth impossible to contradict we perceive not objects without us. The Sun Moon and Stars are by no means seen, because it is not likely the Soul sallies out of the body to contemplate those objects.

DES CARTES takes it for granted, that what we immediately perceive must be either in the Mind or in the Brain. Sound Colour Taste and Smell are sensations in the Mind, which, by the laws of union between Soul and Body, are raised on account of certain traces in the Brain. These traces are in nowise like the things they represent or by which they are caused, neither is perception one single act of the Mind but may be resolved into an effect produced by a series of causes.

LOCKE maintains that the whole contents of the Mind are derived from the Senses. The knowledge we have of any thing except God and our own Soul, we can have only by Sensations, and the having an idea in the Mind no more proves the existence of that thing externally than the picture of a Man evinces his being in existence, or than the vision of a dream is thereby a true history. It is therefore the *receiving Ideas from without* which gives us the knowledge of other things, and makes us know that something doth exist at the same time without us, although perhaps we neither know nor consider how it is.

All our knowledge consists entirely in what we know by the Senses and by reflecting on what is so acquired, as all knowledge is deducible from them and all increase of knowledge depends on them.

Knowledge is nothing more than the perception of the agreement or disagreement of our Ideas. Hence it is true the Mind knows nothing of externals immediately and only by the interposition of Ideas it has by them. Hence our knowledge is real only so far as there is any conformity between our Ideas and the reality of things. But shall the Mind when it perceives its own Ideas only, know that they agree with the external material things themselves.

BERKELY'S opinion is, that Sensations can never be even copies of the real objects which produced them. An affection of the Mind cannot be a copy of any thing not resembling Mind. Can, he asks, a picture in the Mind and a material landscape be the same or even a likeness of the landscape. No thing can be perceived but Ideas, and how can that which is sensible be like that which is insensible. And how can a real outward thing, which is invisible, be like the sensation of colour, or any real thing not perceived, be like the sensation of sound. Can any thing be like a sensation but a sensation.

HUME insists that impressions made by the Senses, and Ideas which are permanent copies of these impressions, constitute the whole with which we are acquainted. The slightest philosophy teaches that nothing can be present to the Mind but an image or perception, and that the Senses are only inlets through which the *image of things are conveyed* by which perception is originated. All Philosophers agree we do not see the external body, and that the immediate object of perception must be some image present to the mind.

DUGALD STUART contends, all must agree we do not perceive externals immediately and of themselves; what is present to the Soul, the Soul only knows; the Soul needs no ideas for perceiving these. And with regard to things without the Soul, we cannot perceive them but by Ideas. Ideas do not make bodies visible, nor does the perception of Ideas represent or make known any thing of the physical cause of our Ideas, Perception is the first and most simple art of the mind whereby it perceives its own Ideas.

ROHAULT is of opinion all a man knows is within himself. All knowledge comes to us by the Senses and exists only within us : it consists in our own sensations and in these consist every thing we know and which are altogether but sensible effects. Bare perception is not sufficient to convince us the thing itself exists. Our reasoning proves no more than that things without us may possibly exist.

GASSENDI and **HOBBES** lay it down as fundamentally true, there is not a single object of the understanding but what is resolveable into sensible effects.

KANT denies the Mind is capable of knowing any thing of what outward bodies really are. All we imagine to be is not really so, we make it so.

RICHERAND most sensibly observes,—in vain were the organs of sense laid open to impressions of surrounding objects,—in vain were the nerves fitted for their transmission,—these impressions were to us as useless or as if they had never been were there not provided a seat of consciousness in the brain. For it is there the Sensation is felt, Light, Sound, Odour and Taste are not felt in the organs of Sense. The Sensitive centre it is that which sees and hears, smells and tastes. *Sensations in which all our perception of objects consists are but modifications of our being.*

DOCTOR CLARKE maintains that without being present to the Mind even the Images of things could not be perceived.

Sir ISAAC NEWTON asks, is not the Sensorium the place where the sentient subject is present, and to which the *sensible species of things is brough* through the Nerves and Brain *to be perceived by th Mind in that place.*

Such are the opinions of some of the most exalted Characters who have made divine philosophy their noble study through life on the subject of perception. Allowing for somewhat of obsolete phraseology and the unreasonableness of forms, species, ideas, and images coming from without and entering the Mind, the whole agree the Mind alone perceives and only as it is excited by the Senses; that its perceptions are of its own nature, consequently such as externals of a material nature cannot resemble. Yet in reasoning on material cases great and small, the same unrivalled Authorities, in every instance, maintain the popular notion of the visibility of bodies, the physical nature of heat, light, cold, luminousness, acidity, and all such, but which are no more material than the Mind itself.

Making flame hot, combustion the effect of heat, congelation of cold, sound something of calculable velocity, light material rays, acidity, flavour and odour qualities of bodies forms a strange contrast with the general conclusion, that human knowledge represents nothing of matter as it really is, but on the contrary most strongly confirms what it cannot possibly be, the like of the knowledge we have by it: yet the whole of the Mind's sensations, without any exception, are maintained in their philosophy as physical, also in the philosophy of the present age considered the most refinedly learned and most philosophic, the shades of which it is devoutly to be wished may pass away before its learning becomes subject to the critical inspection of a future and superior age of knowledge.

In Newton's Optics is a Definition of light and colours, which includes the whole of the principles of perception and by himself developed; it is this: "The homogenous rays which *appear red* or rather *make objects appear so*, I call rubrific or red making; those which make objects appear yellow I call yellow-making and so on of the rest; and if at any time I speak of light and rays as coloured and endured with colours, I would be understood to speak not philosophically but grossly and according to such conceptions as vulgar people on seeing these experiments would be apt to frame. For the rays, to speak properly, are not coloured; in them there is nothing else than a certain power and disposition to stir up a sensation of this or that colour. For as *sound in a bell* or musical string is nothing but a trembling motion and in the Sensorium 'tis a sense of that motion under the form of sound, so *colour in the object* is nothing but a disposition to reflect this or that sort of rays more copiously; in the rays it is nothing but their disposition to propagate this or that motion in the Sensorium and in the Sensorium it is a sense of that motion under the form of colour."

Of the foregoing definition, it should be remarked the several expressions, which, if taken literally, are contradictory of the Author's intended meaning and the principles he lays down. Thus, *the rays which appear red or make objects appear so,*—nothing can appear red or be made so not red in itself: matter is not red, there is nothing outside the mind coloured. What is red is the sensation, and the appearance consists in the sensation being seemingly belonging to the external body to which the eyes are presented. Again, *sound in a bell*, the expression should have been, sound by means of a bell, so as to have it understood "sound is but a sensation in the sensorium."

In like manner by *colour in the object*, is meant colour in the Mind promoted by the external object.

By the Definition, which, in import is indisputable, the whole we know by the agency of two of the Senses, the seeing and hearing, consists in Sensible effects "stirred up in the Sensorium by certain motions there propagated;" and as the entire of the Senses have been formed for the like purpose, to stir up sensations in the Sensorium, it follows unquestionably that the like of any thing stirred up or excited in the Sensorium cannot belong to brute insensible matter. Still the same most highly talented and learned philosopher—whose name is so identified with Science that it might be imagined the whole originated from him and his experimental labours—whose opinions for more than a century and to this day are so tenaciously maintained that few have the confidence to express the slightest doubt against any thing advanced by such a universally admired authority unless indifferent to the accusation of committing a heresy in Science;—Newton himself imputes both colour and heat to Matter and Bodies. Bodies, he says, acquire heat: the Comet of 1680, was 2000 times *hotter* than *red hot* iron at a *white heat*, but which, and although from Newton, is as extravagant as making the sensations of heat and colour belong to the Comet and Iron, as calculating the quantity of sound in the metal of a bell and as demonstrating the amount of pain in a lancet.

Altogether there is no accounting for such aberration of reason in the writings and opinions of learned men. It may however, in defence be said, that as Newton writ in the popular style and agreeably to "the conceptions vulgar people would frame," he had changed his opinions and prefered the popular theory. But his opinion was not changed while writing "The Optics" or his reason for the change would have been given and the celebrated *Definition* expunged. Popular language is not the language of the philosophy of Nature; it falsifies facts, substitutes fallacies, and misleads those the most desirous of obtaining the truth. Had the immortal Newton conformed strictly to his declared principles and the general conclusion to which they lead, we should not now have a species of philosophy founded on unreal causes, nor the only and true cause, *Pressure*, so generally overlooked, although universal and all-sufficient. And had he not misinterpreted the principle of *Inertia*, had he made Inertia *nothing* instead of a resisting, force and rigidly maintained that nothing of effect is attributable to *inert* matter, philosophy from his hand could admit of no amending. It would have long ceased to be encumbered with imagined causes, not only such as are merely sensations, but occult powers of attraction, gravitation and repulsion for the like of which ancient philosophy is so justly ridiculed; and the whole catalogue of causes, laws and false principles would have enjoyed a century at least of merited oblivion. Newton was the greatest Philosopher of the age in which he lived; notwithstanding which his theory of light, colours and vision was greatly and reasonably combated by his contemporaries; but as the contrary could not be shown it prevailed and became established. He, less than any Philosopher, was indebted to former discoveries for his opinions. The mind whose foresight could ascertain that bodies—then considered a simple element each,—Water and Diamond, are combustible, therefore decomposeable, wherefore compounded of different elements, was capable of effecting the greatest discoveries deducible from profundity of thought.

Locke, also, while admitting the true principles of perception and that the whole of human knowledge consists in sensations and resulting ideas, embraces at every opportunity, when reasoning on externals, the popular opinion. He says, our Senses bear witness to the truth of each others report, for if we doubt our *eye sight evidence* of the existence of fire we have only to *feel the fire* to be convinced :—I ask, to be convinced of what ?—not that the fire is seen or felt; only the sensation of colour is known by one sense and the sensation of heat by the other. These perceptions may be said to convince that fire is present, but they are not convincing it is seen and hot. Feeling heat is not feeling the fire even did the hand touch the live coals, and then the heat and pain felt are equally but sensations. The fire may be touched but cannot be felt; touch is mere contact, and feeling being confined to the Mind is not a faculty of the hand, its flesh, bones or nerves nor of the whole together. If, says that enlightened Author, the most instructive of the Senses, seeing, were in any Man one hundred or one thousand times more acute than it is by the best microscopes, things several millions of times less than the smallest objects of sight now would then be *visible to the naked eyes.* I think, he adds, no person can be so sceptical as to be uncertain *of those things which he sees and hears.* Again, whilst I write, *I see white and black* by the testimony of my eyes which are *the sole judges* of those things. Here we have the greatest Metaphysician pleading in favour of mental evidence, by means of the Senses, being seeing externals by the Eyes and hearing by the Ears; also insisting that bodies are some white some black, and indisputably so from being looked at and seen of these colours by the eyes. He says, his eyes see both the white Paper and black Ink, after having said, "shall the Mind, when it perceives its own ideas only, know that they agree with the external material things themselves, it being true the Mind knows nothing of externals immediately and only by the interposition of ideas"—Query? does then the idea of black or white bear testimony the outward cause is either.—The proving an idea in the Mind, he says, no more proves the existence of that thing externally than the picture of a Man his being in existence. After this most explicit declaration, who could imagine Locke would say he knows Ink is black and Paper white by the sole testimony of his eyes, while of these colours, he acknowledges, we have but ideas to judge from which make nothing whatever known of their outward causes. What testimony then is there that black belongs to Ink and white to Paper excepting it can be proved that ink excites in the Mind an idea like itself, a black idea, and paper a white idea. While Newton and Locke maintain sensations and ideas are the whole we know, that these determine nothing of their material causes and that bodies possess nothing similar to sensations and ideas, their philosophising on contrary principles—which cannot be considered any implication on their sense and reason,—looks as if truth and knowledge, even in physical philosophy, from something like motives of priestly gone-by policy, ought to be retained as a priestly secret mysterious and safe only in the keeping of the most learned, therefore should be interdicted from becoming common, as was the knowledge of the form of the Earth, lest, in those days, it should prove injurious to the faith.

The foregoing opinions by a host of the mighty in learning and talent, when tested by the functions of the Senses, respecting sensible effects being all we know, are incontrovertible and the contrary by whom or how applied untrue, although the whole of the present day philosophers philosophise in open violation of the entire. The subject however admits of further illustration in proof of externals being unknown and that the numerous qualities and properties imputed to them have no existence in Nature but as sense-excited sensible effects.

By means of the functions of the Senses only does the Mind know any thing. That the whole of our knowledge, however extensive and refined, has been, in the first instance, excited by the Senses in the

Mind is certain, from its items being traceable to the agency of one or other of these organs. Thus, all we know of light and colours, of what are considered the brightness of day, beauties of the landscape and the whole by study, is traceable to the functions of the visual sense; all by conversation, speech and of sound generally, is traceable to the hearing sense; and of heat, cold, hardness, flavour and odour to the feeling, tasting and smelling Senses. By means of the Senses only is the entire stock of human learning acquired; in sensations and ideas resulting from reasoning on sensations the whole consists, innate ideas and knowledge being as absurd as worldly information and acquaintance with this or that language before or at the instant of our nativity; and out-of-the-world information, from Revelation, the knowledge is evidently acquired through the medium of the Senses. In the absencc of what is known by the Senses there is nothing known, and by the Senses nothing can be known but sensible effects. If one of the Senses be injured or decayed, of one entire source of information the mind is deprived; did a second sense become useless the entire of another species of knowledge ceases to be acquired; were all the Senses in the like unfit condition, from disease or age, the Mind would wholly cease to acquire information; and were it possible for a human being to enter the world without any of the Senses, such-a-one during animal existence would have no knowledge whatever, be ignorant in every respect of the things of the world in which he lives and even unconscious of personal being: or were all the nerves of sensation of any living person detached from the brain, he would know as long as he lived no more than the dead. No greater proof can be advanced or required that the whole any one knows, however extensive his knowledge, has been acquired by the agency of the organs of Sense.

A Sense consists of an external organ, as the Eye or Ear, together with its nerves of sensation which extend to and are inserted in the brain; and from the brain receiving the nerves of sensation of all the Senses, into which the whole are inserted, this organ is common to the entire of the Senses. If the brain be excepted, there is nothing to constitute a Sense but the external organ and its nerves, to either of which it is unreasonable to impute a perceiving faculty.

Next, of the functions of the Senses. That a Sense cannot act of itself not even to excite the brain, is manifest from external material means being necessary to put it into an acting state. Unless the retina be impressed by the visual medium there is no visual perception; nor is there sound excited unless the tympanum be previously acted on. As the nerves of a sense become acted on by the common sense-acting medium, they act on and excite the brain, in which their office solely consists and there it ends. A Sense in itself is as passive as the strings of a Violin: to be otherwise it must be forced into action like any other piece of mechanism, and the acting cause, as in every instance of impulsive action, must be in contact with it. Bodies do not act on the Senses, but on the medium with which they and the contents of the nerves of sensation are in contact; and that which connects the nerves imediately with outward bodies is continuous within the nerves to the brain, and from the brain and nerves to the remotest body of which the Mind has sense excited knowledge,—therefore is of a subtler nature than atmospheric air which has no access to the nerves and brain—is included in and extends beyond the atmosphere to the remotest known stars. By a connecting medium only can the brain be affected by a remote body.

The Sense-acting cause can affect the brain only by its pressure. It is altogether hypothetical the notion of atoms of light spinning on their axes, some exciting the sensation of red, others of yellow, others of blue by their motions on the retina. But as the different strings of a Violin are made to vibrate by the same bow, and as the most complicated machinery is put into an acting state by a single power, a common Sense-acting cause is alone required to effect impulsive pressure and changes of pressure on the brain and make the variously constructed Senses act on the different organs of the brain so as to excite in the Mind every variety in Sensation. The sense-acting medium constitutes what has hitherto been named the nervous fluid. By the changes of pressure it undergoes the organs of the brain are differently excited, not by the fibrine tubes of the nerves, and all sensations are promoted as pressure on the brain by the contents of the nerves is more or less lessened. The maximum or natural degree of pressure is unproductive of sensation: as circumstances take place outwardly to reduce pressure on a sense and the brain a sensation is excited. If more be required to promote variety in sensations by means of the same sense, such as red, yellow and blue, by the optic, different sounds by the auditory sense and different flavours by the sense of taste, we have the several organs and functions of the brain for their production. The Phrenologist may deny the existence of undiscoverable organs in the brain, but which would be refering all variety in sensations to the senses being differently constructed although by the whole the brain is excited in a similar manner by similar means; from which it is inferable the nerves of a sense are ramified in the brain and connected with few or more of its different organs according as sensations by the same sense are more or less diversified.

That to the external organ of a sense, the eye or ear, the faculty of perceiving cannot belong is obvious, from there being no perception when from it the nerves of sensation have been separated. There is nothing seen by the eyes or heard by the ears when the optic and auditory nerves are detached from the eyes and ears. And as little does perception belong to the nerves of sensation, for if they be separated from the brain, and although still naturally connected with their external organ, there is no perception excited by them: in this detached state when separated from the brain, they may be punctured, lacerated and even cauterised without sensibility being in the least excited. A mere ligature on them, by rendering their continuity to the brain less perfect, lessens their capability of exciting the brain and promoting perception: to prevent perception as much as possible as well as stop unnecessary effusion of blood the tourniquet is applied in cases of amputation, not to destroy nervous sensibility, but lessen mental excitement.

That the brain is not possessed of the faculty of perceiving is manifest, from its quantity being frequently lessened, by part of it having been taken from the cranium without lessening the mind's perceptions. Hence, and from perception being identical with consciousness, the faculty of perceiving cannot belong to any corporeal part.

Of the Mind nothing can be known, it explains nothing of itself, its nature and attributes; it is incomprehensible even to itself. It cannot however be considered belonging to or emanating from mere organisation, nor in fact any thing distinct from the Soul, or else it might be said concsiousness, sensations and ideas have equal claim each to individual distinct existence. The Mind can be viewed only in the light of an attribute of the soul, if not the immortal soul itself, subject to changes of consciousness on which it reasons and reflects while present and when past holds in recollection; only as it is excited does it know; in syncope it is not excited and in insanity of the brain it is excited inconsequentially.

A sensation in the Mind is nothing coloured, sonorous, hot, cold, acidulous, aromatic, hard or soft; it is nothing distinct from the Mind's present state of consciousness. The being conscious of a mental change or effect is the whole constituting a sensation and the object at all times seen, heard, felt, or, speaking generally, perceived; it is but a sensation that constitutes an object of taste and smell: the body promoting this or that sensation can possess nothing similar. Matter cannot be considered of various colours, much less noisy, flavoured and aromatic. A Sensation is as a coloured shadow to the body by which it is promoted; as form to body; as the figure of an ace on a card to the card; as a hole to the paper in which one has been cut; being but a present state of consciousness it is consciousness under its latest excitement.

Perceiving an object by the agency of a sense, is but being sensible of a recent change in consciousness, in consequence of some organ of the brain having been recently excited by the matter of sense within the nerves of sensation the pressure of which from external circumstances has been lessened. In perceiving a sensation it is not physical light, physical heat or physical acidity with which we become acquainted, nor are there any such in physical nature. There is no alternative, but, that, bodies are the like of what we know by means of the Senses, and then the whole is Spirit: or, Sensations are material emanations from bodies conveyed by the Senses to the Sensorium: or, Sensations are sensible effects originated in the Mind by causes possessed by nothing similar.

So far from being possessed of as many faculties of perceiving as Senses, we possess consciousness only or that to which alone consciousness can belong, the Soul, which is passive in the originating perceptions but intellectually active in reasoning on them when excited. And so far from perception extending to the knowledge of external bodies these are to us as unknown as what may exist out of Nature and as circumstances in the most distant futurity.

If there be certainty in any thing we know by the Senses it is, that externals are in a manner the contrary of our knowledge. Bodies are material our sense-excited knowledge by them immaterial, therefore to what Sensations indicate bodies cannot bear the slightest resemblance. The body which excites the sensation of heat is in a contrary state, inasmuch as heat is nothing but a sensation; that which promotes the sensation of colour we have every reason to consider devoid of colour, and that by means of which sound is excited we are certain is perfectly silent. Hence, were bodies hot, acid, coloured and noisy, sensations indicating the contrary would be what the Mind should know, and what our present sense-excited knowledge should make us conclude is the fact.

Some say the same body is blue which another considers white, which may be owing to difference of retina one being more or less callous than another. In some diseases we say the fire is devoid of heat, in others that every thing is sated with heat. The same food which in health is considered of most agreeable flavour and odour, during indispositition is nauseous in both respects. These well-known facts shew clearly that qualities of matter are not what we know by our perceptions. It is universally imagined that sweetness is an essential quality of sugar, but as even sugar is bitter to the "diseased in palate," it may be asked which it is really, sweet or bitter, if sweet why should it have a bitter taste; only because the changeable sensation constitutes the object of taste. Sugar has no flavour although by it we experience the sensation, sweet. Sugar is constituted of elementary atoms only, and were they sweet the quality is not extractable elementary atoms being immiscible and in no respect alterable. Hence in the sensation only consists sweet. The like is maintained of acidity, a quality imputed to bodies which enables them to act on and corrode the substance of other bodies. Atomic matter is not acid, there is no elementary acid; were there any such to its atoms the quality would be useless: atoms being inert no action could take place between them and those of the body containing them, much less on those of another body, neither can matter generate acidity. Acidity is considered a general agent, but where is it to come from it being neither natural to matter nor is matter capable of originating an elementary quality of any kind. It is equally so with odour: for an emanation to be odoriforous its atoms should possess odour, but what of odour can emanate from an atom not atomic, and then how is an indivisible atom of odour to develop odour. This being granted in cases of odour, flavour and acidity, sound, cold, heat and luminousness have as little connection with the atoms of matter in bodies. It is contrary to the economy of Nature that matter should be of different species. Unalterable atoms of inactive essence, under a state of pressure, are the whole of matter and cause constituting the material world; all we know by which as sensible effects we impute to bodies, which is contrary to the natural fact and but philosophic device.

It may be said, that as we know by the sense of feeling, hardness, with which the physical fact agrees, why not by the other Senses arrive at equal certainty

pecting the qualities and states of bodies. If a
ly be hard, as our knowledge by the feeling sense
ls us is the condition of the body touched, so
uld bodies correspond with that we know by the
ing and all other of our senses. This suggestion
wholly founded in error. It is not hardness of the
ly, physical hardness, we know by the Sense, but
own inward feeling, the sensation excited by
ssing against a resisting body, little or nothing of
ich is excited when the body gives way upon be-
touched. A suspended body, however solid, is
known to be hard when touched and gently
ved. Nothing promotes the sensation of hard-
s more than closely confined water under extreme
ssure, yet we say water is soft. There is nothing
urally or truly hard which is penetrable and divisi-
; hardness is a quality that belongs only to atomic
stance, all other things are but relatively hard,
l are considered hard or soft although constituted
equally hard elementary atoms, according to the
istance they present against being divided. Sense
touch is a misnomer: there is nothing known by
re touch. Touch and contact are the same. To
e the sensation named hard excited, the hand
st be pressed against the body, which in a degree
ders the sense-acting cause within the nerves dis-

continuous with its like in space generally, by which the exciting pressure on the brain becomes lessened and the resulting sensation is all we know of hardness. As the same body is more strongly pressed we imagine it harder than at first. So far from feeling by mere touch we may be insensible after a while to what we are touching, although by it a feeling had been previously excited. Let the hand rest on the hairs of a clothes-brush, and at first some feeling is excited, but after a while, and the attention being otherways directed, the person might forget on what his hand is placed until by some motion of the hand the sensation of feeling becomes renewed in the Mind. Hardness by the feeling sense is as luminousness by the visual sense; and the maximum of each is the sensible effect resulting from the minimum of pressure by the contents of the nerves of sensation on the brain. The atoms of matter are assumed to be hard in order to establish a fundamental principle in physical philosophy, with which reason agrees there being no occasion whatever for their being otherwise, and even of this being the natural fact we have no means of ascertaining. Of bodies being hard as little can be known, the sensation is not hard and is the whole we know by the feeling as well as by every other Sense.

Some raise the objection, very inconsiderately, that, having knowledge of Sensations only is denying the existence of matter and a material world, and making Sensations the whole that exist outwardly of the Mind. Hence, they say, as fire and that by which the head may be broken are nothing either hot or heavy, the pain by a bruised and fractured skull should cause no uneasiness; pain being but a sensation, is altogether imaginary. How denying materiality to heat and pain can be interpreted denying the existence of fire and the weapon is somewhat non-inferential. The Theory of perception does not inculcate that sensations exist externally, subject at will to be, as it were, inhaled by the Mind; that they are originated by the Mind; or, that one sensation begets another. Outward material causes are undeniable by human knowledge and reason. Hence it is but mere trifling in those who say that because in sensations consists the whole we know by the Senses there can be nothing in Nature else. Neither are heat and pain imaginary nor at the command of will either to excite or remove; each is real of its kind promoted by means of a different kind and so long as Sensations and their outward promoting causes are maintained to be essentially different so long must the existence of Matter be admitted.

With more apparent reason it might be advanced, that, having knowledge of Sensations and none of bodies, is disproveable by Sensations being unknown to ourselves where they only can be, in the Mind; whereas no one imagines light, colour and sound within himself nor other than external things, seen and heard. That, as we find bodies where by the eyesight we know they are situated, which, when arrived at and obtained make no discovery of their nakedness or being in any respect different from our knowledge of them by means of the Senses, and as all men cannot be under a delusion, it is far more reasonable and convincing that what we know is of the bodies themselves than mere effects within our own person.

To meet such objections after what has been stated of the functions of the senses, the shortest mode whereby to convince the reflecting, is, to refer to the natural law, and leave the adoption dependent on its general application or its refutation on radical exceptions. The general and natural law is this: *The Sensations which external material causes are accessory in promoting seem, to ourselves, to belong to those causes*: which makes it obligatory that in every instance the outward cause should be considered the object perceived and similar in all respects to the sensation of which it is but remotely the cause.

According to this apparently unexceptionable law, the colour or visual sensation a body promotes in the Mind seems to be located outside of us, to belong to the body, to be the body itself seen and the colour of the body; whereas the body is only the apparent place of the sensation of colour. So by directing our steps to this but apparent place of the sensation, finding the body and the perception remaining the ame, produces the conviction the body itself is pereived, that its superficial appearance is as the sensaion of colour and that all other sensations promoted y it are qualities which belong to the body. Hence t is, that, to bodies are imputed colour, heat, cold, uminousness, acidity, sound, flavour, and odour.

Let it, for an instant, be imagined the eyes look ut of themselves; that by rays of light a sensation f colour is originated; and that the sensation is omething which covers the body to which the eyes re directed. In this case the imagery covering ould be seen but not the body underneath it, yet rom the body being tangible it and the sensation ould be considered identical. It is similar with all ther of our perceptions, each seems to belong to its xternal cause. Hence we are forced to conclude olour belongs to bodies, heat to fire, cold to ice and cidity to aqueous menstrua. It is also similar with pain; all think it exists in the affected part of the living body; it is there but apparently and for a most wisely ordained purpose. Were the sensation not seemingly at the diseased part all remedial measures for its removal or mitigation would be applied, if not to the seat of sensibility, at random to this or that part of the body: particularly in cases of internal disorganisation and disease is the design most wise.

The knowledge of distance is acquired by reasoning comparatively on our Sensations, but requires much habitual reflection to make perfect. The infant imagines all things within arm's length the Moon equally as the candle. The patient recently couched thinks every thing nearly touching his face; and doubtless there are instances, but from not being appreciated are not communicated, wherein the object perceived is recognised as being internally located. In fact all persons at one time or other of life experience something of the kind, recognised as being within themselves and similar to what in ordinary cases is considered as being produced by, from belonging to, external bodies. Thus light is seen within us from a blow on the closed eye; sound and singing is said to be in the head; distastes and nauseous odours are imagined in the Senses and are known by means which have neither; heat is felt as if in the whole body in the absence of fire during fever and cold in the limbs during the ague before fire. These being similar to what are considered belonging to bodies outside of us, are additional proofs the whole at all times are equally but sensible sense-excited effects, therefore foreign to matter and bodies.

Our perceptions being located externally, as we are compelled to imagine, is strongly exemplified in dreams, wherein persons and characters, scenes and circumstances and the whole variety of sensible effects common to daily occurrences are known as if existing and taking place before the face, yet equally impossible they can be there as an image of the face behind a Mirror and of the Moon beyond the water's depth. To account for the whole by a general law is alone allowable; and however strange and unaccountable it is that the sensation should belong apparently to its outward cause the fact is indisputable. Heat like every thing the Mind knows by a Sense is but a Sensation, it seems to belong to the promoting fire, and can but seem, as its like from being a changeable quality cannot be either a state or quality of the Elementary Matter of fire. Sound is nothing substantive, therefore can be only a Sensation yet seems to be in the air. A body seems to be coloured, that is possessed of the sensation in which alone colour consists; and taste and odour seem to belong to the morsel of food in the mouth, which is equally impossible as sound in a musical string and musical notes in the air; which leaves the general law incontrovertible. Were not this the fact, and from sensations being the entire of what by bodies we know; were our sensations internally recognised we should be totally ignorant of even the situation of externals. We might sow but for where to reap we should be as gropers in the dark; sensations would be useless; of outward things we could have no constant uniform information, and our knowledge would be as little beneficial as the mental scenery of dreams. Without knowing how organisation is productive of this wonderful effect, the services, advantages and enjoyments by it are incalculable; by it all things, after a manner, become known; all appear really beautified and but by unreal appearances, and the whole is made tributary not only to the conservation, comfort and convenience of the body, but improvement of the intellectual faculties of the Mind.

Our Sensations appearing to belong to their outward causes, by which we have a relative knowledge of bodies, may be looked upon as emanating from our wonderful system of organisation and the incomprehensible union of Soul and Body. Connected with which is our ideal knowledge of Magnitude, which is the consequence of the whole of the anterior surface of the body to which the eyes are presented being concerned in altering the visual pressure on a portion of the retina of similar shape, which has the effect of making the resulting sensation seem to cover the entire of that surface: proportional to the surface the sensation seems to cover is the idea of magnitude and hence the perception to us is at times so much larger than our own body. What may be our infantine idea of size is difficult to ascertain, but like that of distance it cannot but be imperfectly formed: of size by adults, it depends most probably on the more or less convexity of the eyes, therefore is different by the same outward body with different persons; still with all, proportion or comparative difference is the same, in the same ratio magnified and diminished.

In this place, towards enforcing the subject in hand, the Principles of Perception, it may be stated wherein Sensations differ from Ideas, these being so frequently confounded by Philosophers, which is evident in the opinions of the Illustrious Authors previously stated. A Sensation is the immediate mental effect resulting from sense action on the brain. An Idea, the conclusive thought arising from reflecting and reasoning on Sensations. In Sensations consist the whole of the original characters of our knowledge; in Ideas all increase of knowledge beyond what Sensations alone originate. In Sensations and Ideas consist the whole of the mind's information through life. Sensations may be likened to the Impression, external bodies the Type and Ideas the subject matter of composition. Hence what notion can be more futile than that so commonly expressed by the learned in Science, of sensations and ideas being received by the Senses from without and by them conveyed to the Mind; and of our knowing bodies by the ideas they communicate. An idea or the sensation of green conveyed from the grass to the optic nerve and by it to the Mind which makes the grass visible, is as irrational as seeing external bodies by images, likenesses, species and forms conveyed from without and impressed on the retina. The Senses are not tubes of conveyance of spectric figures any more than of thought and sentiment, but consist in instrumental means whereby, through the medium of the brain, the Mind has changes effected in itself; which changes indicate not only the existence of invisible external causes but that among these causes change is taking place incessantly. To make known to the Mind the existence of external bodies requires nothing of images species and forms conveyed to or formed in it. The theory of spectral images has been handed down from the earliest ages and confirmed, as already noticed, by misinterpreting the refined experiment on the dissected eye. So far from there being any thing of image proof by the experiment, by it there is proof of there being no image on the retina; for were any thing substituted for the retina, were a slip of paper applied to the back of the globule of aqueous humour there would be no image on it even apparently, as only apparently is that supposed to be really on any globe of water, including that of the eye. Such theories and illustrations are humiliating to the understanding and should convince that Learning and Knowledge are not always the same. In much learning there may be little knowledge. Knowledge is but another name for truth and truth is the actual fact positively or relatively, but not incorrectly, made known to the Mind; what is otherwise based is but false information. Knowledge in Physics is that which directs to the General Cause and leads to its general application in the Works of Nature and Art. "Our only knowledge is, we nothing know;" not however in the Poet's sense, that, out of an infinity we know but little, it being our destiny to know nothing whatever of any thing as it is actually in Nature. From Nature the whole of our Philosophy is deduced, the knowledge of which is wholly relative as to facts and circumstances, and positive only in principles which are undeniable, of general application and consistent with the inertia of Matter. Of all we know there is nothing certain but abstract truths.

Newton, in stating that the essential nature of Matter is not discoverable, says, divide a body as often as we please it is but surface we see and but the separation of atoms is effected: atoms being indivisible their nature can never be ascertained. The latter assertion should be received as indisputably true, it constitutes one of the few fundamental principles of physical Philosophy; the previous is fundamentally erroneous, for even mere surface is not seen; nothing is visually known but the sensation of colour: coloured surfaces it is physically impossible can exist and uncoloured surfaces it is morally impossible to know. Seeing surfaces by knowing colour amounts to seeing coloured surfaces in contradiction to "the definition" which makes colour "a sense of colour in the sensorium," that is, a sensation therefore foreign to surfaces.

So little are the numerous services of sensations understood according to what their origin and nature indicate, that the most egregious mistakes are committed and promulgated by some of the most learned

Professors of the present times. It has been published to the world as knowledge, that is, the natural fact, that, *a sensation may be excited and not perceived, we may be unconscious of the fact.* But which is the same as being insensible to a sensible effect, unconscious of excited consciousness, and although sensations and consciousness are the same the former being but modifications of the latter. It is absurd, the being unconscious of a state of consciousness. It is also said, *pain may exist in the frame and be unknown: a bone may be exquisitely sensible yet give no pain; it may feel acutely and not send its sensations to the brain, owing to the insensible sensibility of the affected part.* This most certainly is philosophising without a single witness. Locke says, one sense bears witness to another, but this is one falsely witnessing against its own veracity. For so short a sentence it would seem impossible to find or compose its equal containing so many positively asserted fallacies. Pain unknown, is as the tooth-ache without pain: a bone being sensible is making the bones possessed of mind; a bone sending sensations to the brain is assuming that sensations are material and subjects of conveyance from one part of the frame to another; insensible sensibility is no sensibility, none excited, or amounts to not knowing what we do know, not feeling what the knowledge of proves we do feel. Insensible sensibility is as a positive and negative axiom in one making no axiom and destroying intelligibility: it amounts to the denial of capability to make a denial. Than which what can be more declaratory of the possibility of the greatest errors being coupled with the greatest learning, and in consequence principally of the Theory and Principles of Perception being rejected from Physical Philosophy.

The truths inculcated by the Theory of Perception are fundamental, few and simply these. The Mind alone is possessed of the percipient faculty: its own Sensations are the whole it perceives: only from Sensations being promoted by external causes are bodies known to be in existence; and, from bodies being of a substantive nature they are in nowise similar to the sensations in which solely consists the Mind's knowledge of their being outside the Mind.

From these principles it necessarily follows, that, in reasoning on bodies, when our perceptions are deducted, there is nothing left of which any conception can be formed but inert atoms in differently congregated states so as to exist as airs, fluids, solids and elementary combinations generally; nor of cause consistent with the inertia of Matter but the existing state of pressure in which the whole of Nature is involved; which is conformable to our ideas of simplicity, a principle it is manifest on which Nature is constructed and on which, it may confidently be said, not only terrestrial Nature but the Universal System of Worlds has been planned. What, to us, can be more simple than all manner of bodies being formed of mere inert atomic substance, and the construction or putting together of the whole productive of Cause by which the entire is maintained in a constantly self-acting state; together with knowing the whole by sensations which beautify the entire beyond what may be actually the appearance of Nature in itself.

The true theory of Nature has remained undiscovered in consequence of our imputing to Matter what belongs to Mind; from not making just discrimination between our knowledge by and the substance of bodies, but confounding with matter the mind's perceptions; than which nothing can more mislead us from the much desired object, that of being enabled to account for phenomena upon the principle of Nature. As there is but unity of cause; as all matter is but atomic substance, wholly inert, therefore is incapable of being cause in any instance; and as laws must necessarily be general and common to all from the minutest circumstance to the most sublime phenomenon, there can be nothing of the general procedure known in any instance and in all its natural bearings but must lead to a knowledge of the whole: and from the knowledge of cause only can any phenomenon be understood correctly. The links however differently formed being all of the like substance and all held together by the same universal means, there is nothing insulated, nothing of exception or anomaly in Nature. But not so in Modern Philosophy teeming with causes not one of which can be accounted for or said in what it consists; all are considered material, possessed by bodies, yet none essential to the atoms of matter. Hence there is much to discard and but little to know to make Philosophy what it should be, the science of cause, the whole at which human research can arrive with certainty.

Before we can reason correctly on Natural Phenomena it should be understood and established on an uncontrovertible basis, that nothing of the whole comes under the cognisance of the Mind much less of the Senses, and that our knowledge by bodies is of nothing belonging to them. We must divest matter of every thing we know by means of the Senses and reason on it abstractedly of the entire. For cause we must seek that which is analogous to effects, known to exist and consistent with the Inertia of Matter; and then appeal for proof to the general consistency and application of the principles of the adopted theory. In which there is nothing new; centuries back the like was promulgated; centuries back Matter and Motion were announced as causing the whole of the Phenomena of Physical Nature; which needed only the cause of motion to be known for the theory being fully established and indisputably maintained. The many discordant ideas entertained of the cause of motion have left that *most of all important question to Philosophy* wholly forgotten. Now, all are content to think that motion is an effect caused by force transfered from the impelling to the impelled body. But when it is asked, what goes out of one into the other; what is force in itself; the answer is, there is nothing transfered, communicated or acquired; of course force is nothing, and motion is the consequence of the state of force a body is put into. So from force being nothing in itself, the inference is, the body goes on of its own accord and because it cannot stop itself; which is making motion to be without cause or caused by the effect of motion, whereas it is commenced, and is continued by Physical Impulsive as long as the motion lasts. It is not, however, in Matter and Motion but Matter and Physical Impulse the Phenomena of Nature consist. The cause of Motion being unknown, inertia considered an

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innate force and the principles of perception rejected as being unconnected with Physical Philosophy, by none has the Theory of Matter and Force been rendered practically useful on natural principles in Philosophy or the Arts, and hence the *rationale* of the Chymist is as foreign to the fact as the reasoning of the most unlearned Artist. Atomic matter under universal pressure accounts for the whole, and without militating in the slightest degree against Mathematical and Astronomical calculations,—so erroneously applied to attraction and gravitition,—respecting the revolutions, periods and laws of the planetary system. At the same time denying the discovery of Cause lies in mathematical reasoning on effects, or why have so many causes at present and all in violation of the fundamental principle Inertia. Mathematical illustrations should cease to be understood as proof of the nature of cause.

As the whole we know has not even the immediate relation to matter which shadows are allowed to have to bodies, of this all should be aware in accounting for experimentally produced results and in philosophising generally, and not reason on unseen unknown bodies as if they and sensations were the same. As the Chymist, previously to commencing operation, considers well the nature of the Instruments and

Vessels to be employed, in order to know what, from attrition and abrasion, of foreign substance may be included in the result, so should the Philosopher be prepared before attempting even the description of a case, to set aside all he knows immediately by his senses and treat the subject independently of the whole, otherwise all his reasoning must be on fallacious grounds. Nor does this suffice, he must never lose sight of the Inertia of matter. Perhaps on the Berkelean Idea he would be nearer the truth, in rejecting matter altogether rather than leave its inertia overlooked or treated as cause in any respect. Inertia can do nothing; it is nothing. By this fundamental principle it becomes undeniable that matter is no cause; it is possessed of neither property nor quality whereby of itself any effect whatever is produced. Unless these principles be rigidly adhered to, nothing advanced by the most learned Philosopher and acute Experimenter can bear the slightest relation to the natural fact.

Philosophy to have correspondence with phenomena has only inferible means and cause, unseen matter in a state of force, on which to reason; unknown matter, and cause consistent with the principle of Inertia. Philosophy should commence at that point which nothing can precede. It should commence with ourself, in questioning the truth and nature of our knowledge by the Senses; whether our knowledge consist in the immediate observation of externals, or if it be not something totally distinct from its remote material causes. In what our knowledge consists is arrived at by following up the means by which it is acquired; the result will convince, that externals are unknown and that nothing of what is known belongs to them.

The being certain we know nothing of externals and why, is no small knowledge with which to commence Philosophising: it strips matter of all factitious appearances and qualities, sets all metaphysical qualities and causes at once aside and leaves the subject to be reasoned on according to natural physical principles. It is no true beginning, that of "doubting our own existence,"—of which we are denied all reason to doubt—in order to prove that of other bodies from our possessing capability to doubt and reason; but which does not prove incapability of doubting and reasoning most unreasonably. The only true beginning is that which leaves inert atomic matter divested of the host of metaphysical causes, qualities, properties and appearances which have corrupted Philosophy and perverted reason from the knowledge of the ways of Nature. This, and our reasonings being controlled by the principle of inertia, there can be no mistaking the wherein true Philosophy consists, all deviation, by those principles, standing self-corrected.

To Philosophise naturally, every phenomenon should be accounted for on general principles, and the whole by the common cause, pressure; which leaves no one case insulated from another and the entire but a system of making and unmaking bodies out of an immense volume of homogeneous atoms, made cause each to another in promoting change in consequence of the whole being under a state of pressure. This may truly be styled sublime simplicity, yet doubtless not as simple as what may be the absolute fact, and is discoverable by merely reasoning on the mind's knowledge, making the proper distinction between the sensible effects in which it consists and the outward promoting means, and maintaining inviolably the Inertia of Matter.

The Mind may be likened to a kind of second self within the human frame, one even busily employed in noticing certain signals, telegraphed, as it were, by external means and the agency of the nerves along the line of the Senses, for interpretation in the Sensorium out of which nothing of the like exists. In its dark cemetery the Mind knows nothing immediately of the several bodies of which Creation consists, and its knowledge is excited in but dumb signs from which it can but infer there are bodies beyond itself.

Adhering to the system of Mind and Matter, and being fully aware that all knowledge of natural bodies is but relative, it is evidently erroneous imputing what is metaphysical to bodies; which is at the same time imputing to matter essential qualities as numerous almost as the atoms of which it consists, while from the whole being inert it is obvious the essential nature of matter is in nowise concerned in any instance whatever. Before the System of Mind and Matter can be set aside for that of all Spirit, it must be proved that Sensations do not constitute what the Mind knows by the Senses. At present in the former System, with but some few exceptions, all agree; hereafter we may know all things differently if there be more than one state of future existence, and evently as the Universe really is, but here Philosophy must have fixt data, which are, Relative Knowledge, Impulsive Pressure and Inert Atoms.

The Theory and Principles of Perception are said to have no connection with Physical Philosophy; as if the Mind read its information from the page of Nature and were perfectly isolated from Matter:

whereas it is the last link in the great chain of effects and to ourselves the first on which the imprint of Nature is delineated by material agency. Those who maintain the contrary cannot be aware of the inability of the Mind to know any thing of its own accord and how it is dependent on externals and material agency for what it knows. They must imagine knowledge is somehow reflected on the Mind through the windows of the Senses, instead of consisting in the Mind itself variously excited by the agency of the Senses. The Mind although immaterial is obviously a part of Nature; and although there is nothing less comprehensible than immaterial effects by material means, still if we do not connect the Mind with Matter the Senses are a useless incumbrance to the frame and the Mind a complete blank in a state of darkness not visible. The Mind is as the subtle Spider in its web of extended filaments, by means of which it is made sensible of existing circumstances and passing events in sensible but evanescent characters. Instead then of maintaining so fastidiously that the principles of perception are unconnected with the explication of physical phenomena, the Theory should be made the great preliminary to the illustration of every physical cause, effect and result, and to all philosophic research having in view the discovery of Nature's Theory.

It is objected also that the Theory and Principles of Perception can be productive in Physical Philosophy of nothing else than a useless change of terms. Were terms unmeaningly altered, leaving the Physical fact in every instance misinterpreted as at present, the objection would not be groundless; but this is not the truth. There being nothing similar in the material world to our mind's knowledge, why should terms be retained that bear no relation to the circumstances to which they are applied, and why should facts be represented by terms which make them different from what they are naturally. Changing terms to others of equally misleading import is still but falsifying facts more and more, whereas rejecting the erroneous and adopting terms deduced from natural physical principles is what reason enjoins and philosophy most strongly inculcates. When it appears evident that bodies are neither hot, cold, luminous nor acid, such terms but mislead, make Philosophy any thing but natural and most effectually prevent the discovery of truth. Out of the whole catalogue of adopted terms not one, excepting Inertia, Impulse and Motion is applicable to the Philosophy of Nature; all others are founded on conjecture and wholly inapplicable to the inert nature of matter. What can be more so than those by which sensible effects are designated hen applied to masses of insensible, inert, unalterble matter. Sensations represent nothing of bodies, ut most emphatically point out that their like has o existence in physical nature. Hence the terms nd appellations familiarly used, expressive of our ense-excited knowledge or mental effects, by causing t to be thought they represent the actual nature, tate and appearance of outward things, are misaplied, and should be discarded from the science of hysics, and those only adopted which are strictly pplicable to the inertia of matter. As respects ause, no term can be correct not expressive of phyical impulse. The terms in use at present apply to netaphysical causes, to unreal causes, and are mere erbal expressions which indicate nothing of the naural fact; on the contrary they substitute fallacious ssumption for fact. The System being mechanical hroughout and the whole of Matter essentially inert, terms expressive of self-acting, immaterial, metaphysical properties, of essential differences in the substance of bodies, should no longer be permitted to constitute the Nomenclature of Physical Philosophy. They mislead reason and multiply causes instead of directing to unity of cause. They render the labours of the Experimenter abortive of the discovery of the common cause and general procedure; by which his trials are useful only as presenting circumstances to after ages when the *rationale* will be deduced on principles altogether mechanical.

In support of the objection that terms only are changed and uselessly, it is said, that, if bodies be not precisely according to our knowledge by our Senses, if they be not hot, cold luminous and acid, still as the substance of different bodies is essentially different, and from being as different as the Sensations they promote, and although wherein the difference lies is undiscoverable, our knowledge makes it certain such is the fact, and warrants the use of terms corresponding with sensations which are familiar to all in preference to others, which, however possibly more applicable, leave the fact no better substantiated. These assertions, although plausible, have no foundation in fact and are greatly erroneous. The nature of Matter is undiscoverable in consequence of matter being unalterable. The knowledge of wherein it consists is useless to philosophy although some have piteously lamented the probability of never arriving at the fact. Were the Elements of matter of different essential natures some object must have been in view, each must have been intended for a peculiarly efficient purpose; but to no purpose whatever if the whole of their atoms be essentially inert. Being inert no atom can act of itself; being unalterable no atom can suffer essential alteration; and from possessing no self-acting ability any essential difference whatever would be superfluous. From which it is obvious that although bodies promote different sensations the essence of the substance of their elementary atoms is neither the sense-exciting cause nor the cause of diversity among bodies, and the matter of all bodies is in the same state as at the beginning unaltered and unalterable, notwithstanding even by the same body we may have such different sensations, as heat and cold.

In addition it is said, adhering to the Theory of Perception in reasoning on physical circumstances, would be reviving the obsolete discarded opinions of the Ancients and the almost forgotten notions of Bishop Berkely. But it matters not by whom or when original opinions have been broached, the question is are they true; have they been understood, or have they been made known in all their bearings by their Authors; and are those by which they have been subverted consistent, incontrovertible and natural. The most true are not always adopted nor the adopted indisputable. What are false cannot be consistent, for error will make itself known, and what are inconsistent cannot be true. Rejection is no proof of error. Aristotle's opinion was, that, intellectual science comprehends the whole of human knowledge, than which nothing is more true. Plato and Pythagorus maintained, that, all things consist in atoms and locomotion; and by Voltaire it was said, abstract or mathematical truths are of the whole we know the only in which there is certainty. Modern Philosophers reject these opinions, and found their Physical Philosophy on the evanescent basis of mental shadows; on knowing what the Mind and Senses together cannot know; and on identifying action with inertia, nothing of which is true or reasonable although the whole are adopted as true.

As to rejection being proof of error, the history of discoveries presents undeniable evidence of the contrary. What the most true and beneficial has not at first been rejected. The gas-light system scarcely any Philosopher patronised in its infancy; and how slowly has not the propelling steam worked its way to make its wonders appreciated. Even the Premier, the Van in all things, denounced steam in the Service impracticable, in the Navy particularly; yet both gas-light and steam are adopted generally; not however through the wisdom or spirit of Philosophers but the enlightened head and skilful hand of the Mechanic. How few, in this age of much learning, comprehend the System of Matter and Physical Impulse advanced by some of the rightly thinking part of Mankind. On the other hand, what the most absurd has not been adopted by the most learned. It was not by the mere Mechanic the Theory of Latent heat was promulgated which all Philosophers have adopted, although in a single line its heinous absurdity is made evident—*latent or insensible heat*, *means*, *cold heat*, *heat without heat*. Of the whole of Established Philosophy what can be true that assumes as physical the like of Sensations and for cause attraction and repulsion by that which is essentially inert. The assigned laws, discoverable from repeated phenomena and circumstances, are most probably true, but cause may be assumed at will; nor does mathematical reasoning discover the fact or prove the error. Were the nominal Nature, or Sympathy adopted as cause, it would make no alteration in laws, effects and astronomical calculations. In the adopted causes attraction, gravitation and repulsion there is nothing rational or Natural, yet each is considered universal throughout Nature. So that there is nothing however true not liable to rejection, nor absurd but what may be adopted. It is recorded of "discoveries rejected and adopted," that the true Solar System was known to, if not discovered, by Pythagoras centuries before its general reception, yet after having been received it was rejected as hypothetical. And after having lain under the cumbrous load of ignorance, superstition and prejudice for eighteen centuries was raked out of the rubbish of former learning by the genius of Copernicus—and is now the Newtonian and only true System. So much for rejection. And as for adoption being any criterion of truth witness the Newtonian Theory of Gravitation, Attraction and Repulsion, which, it is said "Newton has proved to the whole world direct and regulate the System." But as gravitating, attracting and repelling cannot belong to inert bodies, formed as all are of inert matter, the adopted theory, in these respects, is utterly fallacious and untrue. Gravitating by the Planets of their own accord is as movement in the lifeless; attraction as the will of the dead; and repulsion as antipathy possessed by a stone. The whole of these and all such monstrocities have origin solely in the theory of Perception being rejected where most applicable, and in coupling Activity with Inertia. The Stagyrite knew better, which obtained from him the incontrovertible declaration, that, as all knowledge we can have is intellectual so by it of bodies we know nothing whatever; therefore there is nothing to philosophise on but Cause; and in the nce of cause consists the whole of Philosophy. which, however obsolete and rejected, all rational losophers will bend eventually, although at the iliating expense of abandoning their former opis and following those of the Sages of Antiquity.

ATTRACTION.

OMETHING of a peculiar power, ability or energy has ng been imputed to the molecules of Matter, which ables them to draw each other together from a stance. This energy or cause has been termed ttraction. By it all formation and change among dies, and all motion out of rectilinear are said to e effected; in promoting the latter the cause is rmed Gravitation.

What Attraction is, whether a self-extending nergy of or an emanation from Matter, none, most isely, have undertaken to decide. In fact there is othing more stultifying to the understanding than e attempt to form an idea of and account for such property; and made more unintelligible when it is ecollected that what is said to possess the power of ttracting is at the same time, considered essentially nert. What of or belonging to an atom can extend eyond the atom is not easy of conception; it must e material or there is nothing; and if material its effort should be to impel in its own direction of motion, not the contrary: no current drives any thing in a direction the contrary of its flow, neither does the wind force bodies out of the direction whence it arose. How is motion from impulse to be effected in a direction the opposite of impulse: and how is that which is inert in any manner to act of itself or promote action, that is, motion, in its like, in a direction the contrary of the act. Even this exhibition of the principle shows the fallacy of the notion, and to such ideas only a just consideration of the subject can lead the inertia of matter being granted.

Throughout the whole of Nature there is not one single instance in proof of the existence of attraction, or attraction being a property of Matter: even magnetic phenomena are nothing in proof. Impulsive pressure by sensible and by insensible means accounts for the whole rationally and consistently; which leaves no office for attraction to fill and the principle but a name for nothing.

What attraction is, whether a property essential to or subsequently impressed on the atoms of matter, we are told is not necessary to know, effects prove that such is the fact and the origin of cause is not an object of philosophic enquiry. After this manner we are taught a species of philosophic verity; to believe that what cannot be, is; that the impossibility confirms the belief; and that, to support the verity, nothing must be something; because perhaps, of some lost "Article" which *once* compelled the belief that the world is as flat as plate and forbid the idea of it being thought round as a turnip.

A body is said to act on another, by its attraction, outside of, beyond itself and where the body so acting is not situated but is greatly remote from the one on which it acts: which is on a par with the notion of force going out of the impelling body into the one impelled before the two have come in contact, according to Boscovich. In fact it is only in the language of unintelligibility any idea can be expressed of this un-immaterial phantom of unphilosophic origin; and only by exhibiting in their true colouring the numerous absurdities consequent on this super-hypothetic cause the fallacy can be met and grappled with effectually, so universally is it believed in as a species physical spirit belonging to every atom in Creation, which does as it pleases with the whole of the atoms of matter and the entire of the bodies composing the Planetary System.

No idea or reason can be advanced of wherein consists the possibility of two elementary atoms, even in closest contact, acting on each other, each of course acting beyond its own surface, both at rest, and without the possibility of either suffering essential alteration. It is equally unintelligible that two bodies, not in contact, could cause alteration of the motion of either by the species of spiritual sympathy attraction is looked upon, each being composed of nothing but inert atoms—While the contrary is considered the fact, it is out of mind that all things are involved in a common medium, the pressure by which is competent to effect all change, merely local, to which the unalterable atoms of matter can by possibility be subject—Nor is it conceivable that two planets should receive, one from the other, a current of matter of attraction passed through the regions of space, which, instead of repelling both, brings them towards each other; yet they are neither repelled asunder nor brought together. Besides, these currents, this twofold flow, this attraction is neither material nor immaterial; and the bodies of the planets to which this power of acting on each other is imputed are constituted of matter incapable of self-acting. For these prodigies to be believed in, attraction and volition should be considered the same excepting in degree, the former being infinitely more efficient than the latter and competent to effect more than "angelic movement without step."

Did the Earth attract the Moon and the Moon the Earth, these bodies should come and remain together, or in no instance of approach is the cause attributable to attraction. Both attractions tending towards the same intermediate point, the greater not drawing the less body to itself, and neither planet removed out of its orbit leaves attraction a mere empty name. Nor is it any reason these bodies do not meet their being in motion, or solar effects on the Earth would be similarly suspended. A body performing rotary motion before a fire is not freed, by its motion, from being affected by the fire, neither should a planet be freed by its motion from planetary attraction, much less two planets each attracting the other. If it be urged the Earth and Moon's attractions neutralise each other, then are both attractions useless. Did the Earth at 240,000 miles distance from its surface attract the Moon, and so forcibly as to prevent it flying out of its orbit tangentially, the the force at the same time being inversely as the distance and directly as the quantity of matter in the Earth, all terrestrial bodies should be retained immoveably fixed so as to bid defiance to the feeble strength of man to lift even a pebble from the ground: a man could not lift his foot; mist could not arise nor seeds germinate upwards; birds could not ascend into the air, a stone be impelled from the hand, nor the greatest explosive force effect projectile motion. And as the same needle is affected much more by a strong than weaker magnet, it cannot be maintained a body is attracted to the Earth only as its quantity of Matter but as the greater attraction of the Earth. Had a large and a small body, one of two the other ten pounds weight, each a fifty pound weight suspended from it, both would be pulled down equally towards the ground; and as a body is affected not only according to its size but as the size and intensity of the fire, so likewise should the smallest body be retained to the ground according to the quantity of attraction possessed by the Earth; still much less would be sufficient to render all terrestrial bodies immoveable on the surface of such an enormous magnet as the Earth is considered. But what is the fact, a host of known circumstances are at variance with the universal planetary attraction. The Planets are not attracted together; and it has been proved, that magnetic phenomena, supposed to depend on attraction, have been produced instead of prevented by motion. Even bodies known to be unattractive—although none should be so, if, according to the theory, every atom in Nature attract its like—wood and copper when put into violent rotary motion promote effects on he compass needle similar to magnetic attributed to ttraction. All terrestrial bodies are loose and moveble; the foot is not retained to the Earth; the lightest puff of wind sends dust from the ground into he air; mists arise and form clouds, birds ascend, projectiles are sent from the Earth; and the smallest winged insect bids defiance to the whole of the Earth's imputed attraction: nothing of which could take place were terrestrial attraction the means of the Moon being retained in its orbit: and were it so, the Earth should attract all loose bodies from the Moon, its inhabitants, hills and even mountains. Were attraction the cause of bodies falling it would have prevented their ascent; nor could the weight of the atmosphere be ever varying the Earth's attraction being a constant quantity and considered the cause of weight.

Were the Sun the stronger attracting body, all emanations caused by it from the Earth would continue rising to the Solar regions, yet none pass the insuperable line which bounds the Atmosphere, but on the contrary quit the sphere of strongest attraction and return to the Earth in the form of Hail, Rain and Snow. Solar attraction is refuted by all bodies ascending from the Earth declining in motion the nearer they approach the Sun, instead of having accelerated motion from the instant they quit the Earth. Were the atmosphere suddenly removed, the clouds would return to the Earth instead of being attracted by the Sun; and were the Planets attracted by the Sun there is nothing whatever to prevent the whole being drawn to this greater attracting body and forming one conglomerated amorphous mass of motionless matter.

Attraction is conceived both a centrifugal and centripetal force; emanating from yet drawing bodies to the Earth; and while every atom of matter is said to attract its like to the whole is also imputed a repelling property, the unreasonableness of which is evident.

In the well known experiment of a feather and guinea let fall together from the top of the air pump receiver when exhausted, wherein both arrive at the same instant at the bottom, there is the strongest evidence of the absence of attraction, although the case is repeatedly brought forward in proof of the existence of Attraction. The greater body being not only attracted by but attracting the Earth it should sooner descend than the one of less matter of attraction. On the other hand it may be said there is reason for inferring the smaller should fall first: for as fire affects the smallest bodies most in the same time, so should the Earth's attraction affect the feather sooner than the guinea. It cannot be maintained the Earth attracts different masses of matter equally or all bodies on its surface should be of equal weight attraction being the imputed cause of weight. Two unequal needles are not retained equally to a magnet the largest is easiest shaken off;—therefore attraction should make the feather and guinea descend in unequal times, but as they fall together attraction cannot be the cause. Both, during their equal velocity, are circumstanced as if floated down a stream and unresisted in their course, by which one can have no greater velocity than the other nor both less than that by which they are carried forward. In like manner Newton's celebrated Apple proves the contrary of what it is said to prove, notwithstanding by it "the whole world has been convinced," that, inert bodies, which cannot put each other in motion while in contact, can do so no matter how greatly separate—the descent of the apple is but motion, which, from being a common effect caused by physical impulse, in nowise implies motion by attraction also; whereas the formation of the apple out of the ascending juices of the tree is strongly indicative of the absence of attraction in the Earth; for to suppose capillary greater than terrestrial attraction but increases the difficulty.

Did a body fall from being attracted downwards, its momentum should be the same at the end of every fall no matter from what different heights the different falls commenced; the velocity being as the cause and attraction constant, the same degree of attraction at the same distance from the Earth must be productive at all times of none other than an equal effect. What is said of motion increasing motion, and motion accumulating in effects within the body which accelerates the fall, is as untrue and unreasonable as motion being the cause of impulse, or an effect generating more cause than that by which it was caused.

All effects attributed to attraction, are not only analogous to those produced mechanically but such as mere physical force is competent most fully to produce; and which, from the unalterable nature of matter, can consist only in aggregation, separation, intermixture and change of place generally of atoms and bodies, for promoting the whole of which the general pressure is all-sufficient. Nothing but pressure is requisite to constitute force, and nothing but pressure is required to act on atoms which can suffer no change but local. In the absence of the general pressure there could be no motion or effect and were it suspended all Nature would be at a complete stand-still. By pressure of the common medium in which all things are involved all matter is kept in a moving state, whereas attraction, by bringing the whole together, would be a motion destroying cause the reverse of one of order. Hence in the constant uninterrupted harmony of the performances of Nature there is the best possible evidence that universal attraction, productive of gravitation, is but a mere nominal cause, for which any other nominal might be substituted and without the least infringing on Mathematical calculations. The true physical cause, the general pressure, when properly appreciated, on the basis of Inertia, cannot but be adopted: and must settle the question for ever of cause, cause of cause, and final cause, and consign the absurd occult cause attraction to its justly devoted obscurity beyond the possibility of being recalled. Already has attraction been too long-lived: and although the cause of motion, hereafter to be stated, may not, to better judges, most satisfactorily be made appear, is no reason why that which cannot belong to inert matter should not be discarded from Physics, particularly as the absurdity is fully proved, and its rejection must necessarily stimulate to the search after cause consistent with the nature of matter.

Planetary motion is but the common effect motion on the grandest scale, similar to atmospheric projected motion and the transfer of the minutest atoms through the smallest portion of space; the whole therefore require but a common cause, and from physical impulse being productive of motion it were idle and contrary to the principle of simplicity to infer the existence of more causes than the general pressure; or else the general pressure should be considered as designed for partial purposes only, which also is contrary to the principle of simplicity. Unequal pressure on opposite sides of a body in a yielding medium must cause motion; unequal pressure, at the same time, on two other opposite sides of the same body, will cause the direction of motion to be diagonal: and if the Sun be the minus pressure means in one of these instances, round it the body must be moved. These different pressures being constant, and without having recourse to either attraction, "impulse once impressed," or central forces the motion must of necessity be endless. In pressure, and in minus pressure means consist the whole of cause and means for the production and maintenance of planetary motion so generally imputed to attraction, gravitation and central forces. Attraction centripetally acting on a planet could effect motion centripetally only; projectile force could produce motion only in the direction of the original impulse, out of which there being no impulse, the Planet would be drawn towards and on the Sun. Therefore impulse must be as constant as motion; for which, it is obvious there must be a medium of pressure. By such means orbicular motion is conceivable without solar attraction, gravity and the unreasonable notion of endless motion from momentary impulse. The foregoing means also include a species of self-regulation whereby all deviation from a perfect circle, and how lost velocity is recovered, may be accounted for. The latter circumstance is not explained by the theory of central forces, much less by that of a momentary projectile impulse, it being certain that renewed velocity can only be effected by renewed impulse.

Were Attraction an elementary property it could neither be communicated to nor destroyed in Magnets; a Magnet is but a work of Art.

Magnetic phenomena are but effects such as are produced by Mechanical agency. What are considered consequences of attraction and repulsion consist in but motion in opposite directions for which it is needless to have distinct causes nor other than the general pressure. External pressure on a mass of atoms is sufficient to hold them together as a solid body and of the greatest known tenacity. By external pressure two cubes of heavy metal and of different kinds, neither magnetic, are held together so that when the uppermost is lifted the other is not left behind. Were attraction the cause of solidity it would be somewhat evinced in the broken parts of a body when put together; whereas when the fracture is most perfect, as with glass only cracked, and the parts pressed forcibly together there is nothing of attractive union effected or in the slightest degree evinced. Were matter attractive in every atom, all bodies should be so, wood as much as iron; airs would be unknown and fluids, if any, immoveable. If it be said the state of the atmosphere depends on atomic repulsion, on the same principle all should be air, there could be no solids. If it be objected that atmospheric pressure is vastly inferior to the tenacity of metals, stone and even wood, let the phenomenon of expansion be referred to, and there will be found that the greatest tenacity is not only equalled but overcome by pressure centrifugally exerted within the body. The same means that can unbind and separate, when oppositely applied can bind together; what expands and renders fluid the densest metal is sufficient to retain, under contrary circumstances, its atoms permanently conjoined. If this do not suffice, look to the forcible expansion of water during congelation, to steam, tornadoes and earthquakes, the force necessary to produce which is included in Nature, and with which the tenacity of bodies can bear no comparison. While atmospheric pressure is calculated by the height it forces water into pumps, the great waterspout indicates the pressure of Nature to be vastly greater. From these circumstances it is evident the general pressure is fully competent to promote bodily solidity, which is but the mere collapsing and retaining collapsed atomic particles, without referring to the occult, inconsistent means attraction.

Those who have gone to Schehalien and the world's end to ascertain the ratio of attraction, have been on a most unfruitful mission to find nothing, to arrive, as it were, at the horizon. The question to know the quantity of attraction in the Earth is answered at home significantly by Zero. On a par with which is, the calculated amount of motion, including, doubtless, its dimensions, in the world.

It is equally idle of those who have negatively complimented Newton for his modesty in not seeking after causes; that great man, they say for him, was content to trace and account for effects; but which is the same as a demonstration of no proposition, an answer to no question. How accounting for an effect without referring to cause is to be accomplished is rather puzzling. Newton assumed numerous causes; such as universal gravitation, attraction, repulsion and central forces, the whole of which are foreign to inert matter and useless to the mechanical system of Nature. Then again we are told, that, as every effect must have a cause and no cause being causeless, the pursuit after final causes is interminable, and this by those who are lavish in their admiration of the simplicity of Nature. God, most assuredly, is the Great First Cause of all things; but who can limit his Omniscience to the necessity of hourly attending on his own divine works to keep them in motion; although Newton apprehended his repairing hand would be required in time to correct the accumulated irregularities of the motion of the Planets. A moderate mechanic forms a Machine that shall go for a length of time without his attendance and the perfection of mechanism is considered the Machine which continues in motion and requires no attendance as long as its materials exist. Shall we then deny to the Almighty Omniscient Architect the ability to form a self-going Universe; the materials of the whole being imperishable, the performance stupendous, the duration is necessarily endless. It is inadmissible that with imperishable means and the divinest skill the works of the Almighty should be less perfect than the limits of possibility and simple in the extreme, which implies the means of procedure emanating from the judicious arrangements of the parts. The whole being involved in a medium of pressure, cause is every where to make part act on part, atoms on atoms; and to prevent the equilibrium taking place, minus pressure means are sufficiently provided. The Universe has been made to be self-acting although no part or atom can act of itself; it includes and may be said to originate its own power. Beyond the general pressure no cause is required. Take away the general pressure n vain is the search after cause; and with it, graviation, attraction, repulsion and central forces are uperfluous incumbrances. One universal means of Power is alone requisite. One answers the purposes of the most complicated human machinery, while to Nature is imputed as many powers as atoms, and these doubled in making every atom not only an attracting but repelling power.

Those who maintain the knowledge of Cause is not required in accounting for effects, may be asked, whether Philosophy can be that of Nature if founded on conjecture, or any experimental result accounted for correctly upon assumed principles. To this all will reply in the negative, but add, that Modern Philosophy is based on principles founded in Nature and mathematically demonstrated. But as the contrary is made evident, when the theory is tested by the principles of Perception and Inertia, there can be no reasonable objection whatever against these principles being made the basis of Philosophy in all its branches. And while we justly and laudibly make boast of the rapid progress of the Arts, it is presumable new discoveries in them, productive of the greatest objects of utility, may be effected by more direct means and at less expense of materials, when the mechanical procedure of Nature in all things is understood and the knowledge connected with Artizan Skill. Nature lends us all her means, but without knowing wherein they consist how can we employ them to the greatest advantage.

The discovery of cause is nothing abstruse when deduced from the inertia of matter. Universal Attraction cannot stand alone, universal repulsion must be added, and the general pressure cannot be passed over, while unity of cause is what Nature itself inculcates. And while the true philosophic spirit occupies the intellectual faculties the discovery cause, the vital principle of philosophy, cannot b be an object of the greatest solicitude to every quiring Mind. Newton's apple has corrupted

ophic as Adam's the moral spirit, both, it is
tly to be wished, are redeemable and long before
riod, when "all shall be made perfect."

Repulsion it is needless to speak. Newton's film
ulsion, is, "embodied nothingness," a stratum
e. Any substantial intervening stratum would
it the immediate contact of bodies but could do
re, it could not throw even an atom from its sur-
ior resist the general pressure forcing its own
into immediate contact. Newton found the
t of a meniscus lens insufficient to bring its con-
rface in contact with a plate of glass, which he
ards effected by force, and thence concluded a
f repulsion lay between. The fact is, elemen-
atter, not easily removeable under such circum-
s, intervened: were the experiment tried under
the hindrance against immediate contact is evi-

The Elements being of unequal rarity in con-
ce of their atoms having unequal size and the
being under pressure, nothing within the At-
ere can be empty not even the interstices of the
of bodies, so when the lens rested above the
t rested on a stratum of elementary matter, not
of repulsion. Repulsion is the sinister of at-
n; to both inert matter is neuter and a perfect
er; it acknowledges neither as either a natural

or even an artificial property, and denies the imputation of being possessed of such mutually destroying antagonist properties.

HEAT.

PHYSICAL heat, or fire being hot and radiating hot matter which enters the hands and surrounding bodies, is a universally received opinion. Philosophers on all occasions impute physical change by fire to physical heat, and consider the feeling excited by fire and the Sun the consequence of the animal frame acquiring from these bodies hot matter. Fire, they say, expands, fuses and destroys bodies by the heat it communicates. Also, that this hot matter spreads among bodies until the equilibrium has obtained which they designate the equilibrium of temperature. The whole of which is refuted by rational and natural facts.

Whence, it may be asked, is physical heat derived. What can make fire hot there being no element of heat in Nature, nothing permanently hot; no element hot *sui generis*. Matter being inert is incapable of heating itself or its like; from being impenetrable, it is incapable of acquiring any thing in its atoms; and from being unalterable it is incapable of being made hot or cold. It is also impossible a mass of atoms can be similar in any respect to the sensation t promotes which is all we know of heat. The fact s, heat is altogether but feeling and we impute to the hysical cause the like of what we feel, but material eat is as unnecessary to promote this sensation as aterial cold the contrary. Hence fire is not hot, or is there in Nature physical heat or a hot body. nd instead of fire communicating any thing to bodies t causes them invariably to suffer less. By its gency bodies are lessened in substance, decomposed, nd their Elements dispersed: hence fire is more of n abstracting than communicating nature. Still, ire does not act of itself, it is but accessory to the removal of the atoms of bodies: it only, in a manner, prepares bodies, by what they lose in it, for the reception of the expanding and decomposing cause. Whatever may be that cause the general fact is, bodies undergo oss by fire: and as the change fire produces is by a uniform procedure, it cannot with consistency be upheld, that fire, while abstracting from, is at the same [illegible]e communicating matter to bodies.

That there is no Element of heat is manifest, from there being nothing of the kind known on the surface, nor in the bowels of the Earth whence all heat is said to retire; from there being no such thing as a permanently hot body, and from bodies devoid of heat being converted to fire without the addition of heat or even presence of fire. What can or is there to heat unalterable impenetrable atoms; and heating them by means which neither add to nor take from them, as is said by mere motion, is contrary to reason, first principles and the general procedure of Nature.

Were there an element of heat the atoms of a body could acquire it only in their interstices; and were these even sated with it, the body itself, from the impenetrable and unalterable nature of its atoms, must still remain unheated: but as an ignited body is uniformly so, the whole being in a like state, it follows that ignition is caused by neither essential alteration of substance, as the change from cold to hot implies, nor by communicated interstitial matter of heat.

The first materials of a culinary fire, wood and coal, are allowed to be cold, yet from but the almost instantaneous contact of a candle-flame the whole become in a short time ignited. If ignition depend on, or were caused by heat, whence has the full of the fire of heat been derived. The coal and wood could not have contained it and remained not only not ignited but cold; the flame could not have communicated it, its entire quantity being insufficient; and as air said to be coldest is best to promote combustion, from this source the fuel could not have acquired heat, much less from the original spark from flint and steel on which the whole depends for being in the state of ignition and fire; and there being no other source, it is manifest fire is not a body sated with heat. Still as it promotes the feeling, we consider it hot. We might, however, with equal reason impute to it the pain it promotes when by it the hand is burnt. In all cases we impute the like of the sensation to the outward cause of the sensation, and, in the popular sense say, fire contains heat, but when we account for combustion, ignition and decomposition by physical heat, the error is rationally evident Nature having no such cause.

Were ignition the consequence of communicated heat, the whole of the fuel of a fire would be heated at once, as by water a sponge is made wet at once; or, ignition should extend no further than the quantity of heat communicated, it being impossible any thing could cause increase of itself. But as ignition depends on decomposition of the fuel wherein nothing is altered but texture; as it is much greater than the supposed communicated heat could effect; and from it being both impossible and absurd the fuel could have been sated with heat and not even warm, together with the rational fact that heat in bodies is not necessary to excite the sensation of heat any more than that matter should be black, white, red and acid to excite these sensations, it is manifest the changes promoted by fire are altogether but mechanical, and the fuel is as devoid of physical heat after as before being ignited equally as of the sensations of pain and redness it causes the nerves of Sensation to excite in the Mind. Instead then of maintaining fire is hot equal to ignition, and, unphilosophically, that matter is alterable from cold to hot and hot to cold, there is nothing to refer to for heat but the Sensation; and but to the abstracting effects of fire for that species of decomposition termed combustion, during which the entire of the elements of the fuel are set free and dispersed and the sensations of heat, light and colour promoted. In treating the whole after this manner we but make due allowance for what are only sensible effects; which leaves the physical fact and mechanical operation to be reasoned on divested of all imaginary and unreal qualities.

It has been said, heat in bodies is the effect of atomic motion, by Sir Humphry Davy it is motion. If it be maintained motion excites the sensation, we get quit at once of physical heat, and must seek some other cause than that of heat for ignition and combustion. But that matter can be made hot by mere velocity is disproved by moving a body through the air to render it unignited ; and by the planets being neither vitrified nor even ignited at the end of at least six thousand years most rapid motion and the whole of the time in the neighbourhood of so large a body of hot fire as the Sun is considered. If motion could make a body hot, from there being nothing communicated there is nothing for the body to radiate, which nullifies the whole theory of radiation of material heat. Again, on the principle of mere atomic motion making a body hot and ignited, how is the continuity of a bar of ignited iron to be maintained, when the molecules of which it consists are so far apart from each other as is indispensable to their freedom of motion even only round their own axes. As motion destroys ignition, and the sooner as the medium is more dense, how is atomic motion to commence and continue in melted iron. Still more, what is to cause this atomic motion, which cannot commence or continue without impulse, which no atom can originate. There is nothing repulsive or impulsive in fire, which consists of merely the elements of the fuel with some of those of atmospheric air, neither can atoms be swelled forcibly against each other; what then is to impel them in any direction. Hence there is no foundation for the idea of matter being heated by atomic motion. Besides, were the heat said to be communicated by fire to the hand the effect of atomic motion, it should be shown, not only how such motion is originated and kept up, but wherein consist the several impelling causes for the different directions of motion, such as rotary in the fire, rectilinear through the air, and sense-exciting within the hand; and why, from these motions and directions continuing without or with impulse they should ever cease.

While two pieces of wood are being forcibly rubbed together, the superior stratum of atoms of each is rubbed away and combustion succeeds. During the rubbing away process there is nothing communicated; on the contrary the wood suffers loss, and the displaced atoms cease to impel those of the next stratum: so that combustion by atomic motion is as unreasonable as ignition. Ignition by percussion cannot be by atomic motion, percussion being rather a motion destroying cause. In beating a piece of soaked wood water is forced out. By beating iron the atoms of the metal are somewhat displaced, there is nothing of heat beat into them. Nor can the atoms by any means be changed in any manner excepting as respects position. Hence as there is no cause of heat it is conclusive there is nothing to constitute heat but the feeling the body promotes.

Caloric, or matter of heat, is still physical heat: it is either matter naturally hot or put into a state not natural to matter: but as all things said to be hot cease to be so, and as matter is unalterable caloric can be but elementary substance neither hot nor cold; and from being latent or included in bodies before they become ignited, it is capable of exciting the sensation of cold as well as heat: and it being the fact that all bodies suffer loss by fire, therefore fire does not communicate any thing, caloric or matter of heat is in fact a name for nothing. The *rationale* of Combustion is—fire and friction remove elementary matter from bodies, the expanding medium enters the vacated interstices and causes dissolution; during which elementary matter is set free which promotes different Sensations, such as light, colour and heat, and we impute to the cause of these sensations the heat and luminousness excited in the Mind. There is nothing of communicated Caloric hot or not hot in the question: heating a body could not decompose it nor disperse its atoms. How is caloric to get into a body and the body afterwards to throw it off. If the body it is said to heat cannot retain it, how is an unignited body to acquire it..Expansion is not by heat but internal physical force which bodies have to acquire or they would be always expanded. There is in fact no office in Nature for Caloric to supply.

The highly eulogised theory of Latent Heat, although composed with the greatest ingenuity and deduced from experiments the most refined, is perhaps the most contradictory, absurd and misleading ever promulgated. Its principles are erroneous, inasmuch as there is no physical heat in Nature to be either sensible or latent; and absurd, from it being in contradiction to Sense and Reason the notion of insensible heat, equally as of insensible pain. Insensible heat within a body is heat out of reach; which leaves heat, as it is conceived, something hot, but not as the theory inculcates, not hot, therefore cold. How the greatly learned and amiable Author could have conceived, composed and promulgated a theory of latent heat is incomprehensibly strange; why not and with no greater inconsistency than of latent heat in Ice, one of latent cold in Fire. Yet the most learned of the day have received the theory and established its principles in Chymical Philosophy. So much for the shallow precept of Bacon, which recommends " tor-

ng Nature out of her secrets by Experiments”
ch hitherto have all been misunderstood, and
ry experimental discovery erroneously illustrated
rein physical heat and self-action by inert atoms
e been maintained. Whereas by reasoning on
sical phenomena with a knowledge of the nature
right use of the Mind's perceptions; on the inert,
efore unalterable, nature of matter; and applying
e principles to cases, not assuming principles from
erimental results, the natural procedure is disco-
ble in almost every instance.

y *The Theory* all bodies contain heat in a latent
e, that is, heat which neither excites the sensa-
nor so much as warms that by which it is con-
ed, and which is unproductive of either ignition,
on or expansion. The assigned reason for which
that, all bodies can be made hot without the as-
nce of fire, as by friction or percussion; the
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be obliterated by white light where is it; not
it in the white any more than the original crystals
atent in a saline solution. How can Ice, which
id to be painfully cold, retain heat and remain

unmelted, and by that which is considered the cause of fusion generally. And why should the setting free or suffering to escape, the matter of heat, make that hot the entire quantity of which when within the body kept it cold. Can motion going out of a body, as it is expressed, give motion to the projectile: yet latent heat, it is said, heats the body most when leaving that body. Flame obtained from the gases of the water of melted Ice, if hot, the whole of its heat must have been contained in the Ice in a frozen state or it should have melted the Ice; or else melting and fusing by fire are not consequences of heat. Ice and cold imply the absence of heat equally as darkness of light, and is proved by ice making the water in which it is dissolved the contrary of hot, but which should be boiled were the flame hot produced out of the elements of ice-water. Wherein is the latent heat made sensible in either melting or pulverising Ice, or the pulverising any other kind of body, even gunpowder. What heats the entire of a barrel of gunpowder instantaneously when exploded by a single spark. If the volume of flame be hot, how was this highly inflammable combustible sated with heat harmlessly, excepting on the absurd idea of the matter of heat being cold and capable of heating itself voluntarily when set free, but which is not the case when the powder is decomposed in water: and how is the presence of caloric or the matter of heat evinced in the unexpanded grains of gunpowder.

It cannot be maintained the substance of the matter of heat is latent; and substance, not state but that of pressure, is the cause of expansion. Were bodies expanded by hot matter, the same matter should occupy an equal space within them were its heat latent or altogether extinguished, which amounts to no heat; they should be at the maximum of expansion at all times, particularly while possessed of, not when radiating, the matter of heat. Wedges do not require being hot nor water boiling to expand wood. Besides, the most forcible expansion is produced during congelation wherein the contrary of heat is most strongly evinced. And how are merely heated atoms to increase the volume of gunpowder and steam. Can the atoms of inert matter remain many times the diameter of each asunder nothing being between; is each possessed of a flying off force. While heat is said to be of a repellant nature, the contrary is evinced in the detonation of gases by flame, which, when applied to a mixture of oxygen and hydrogen, is productive of water which is but two thousandth the volume of that of the gases employed; in which case it is proved to be more of a contracting than expanding nature. Taking all these circumstances into consideration, and that all we know of heat is a peculiar kind of feeling, there is nothing can reconcile such evident opposites but the receiving all effects by fire as mere mechanical changes without heat, and confining heat to the feeling which is excited according to the circumstances of the case and the nature of our organisation.

Next, wherein is there any evidence of the equilibrium of temperature, or degree of heat, thermometrically indicated. Not in the liquids on the Chymist's shelves, the whole of which affect the meter differently at the same time. Nor in the blood and flesh of the living body, the former indicating 96° while the latter may depress the quicksilver below 50°, and while the blood is said to be acquiring heat at every inspiration which it communicates to the body; nor even in a culinary fire, one part of which may be in the highest combustion while the rest is many removes from ignition.

The Sun, Newton says, is a body of fire vehemently hot but without alluding to what maintains the ignited state. It is considered the source of all terrestrial heat, yet the nearer it is approached, by a baloon or climbing the highest peak, the colder are our feelings. Even from the Clouds there is natural evidence of here being nothing of Solar heat, in their Messengers to the Earth of what may be termed solid cold r hail stones. Were the Sun a body of hot fire, we ught to receive boiling water from the Clouds instead of refreshing showers. The Sun's rays, which re said to burn by their heat, pass through a lens of ce without melting it and ignite gunpowder; also har a cork suspended in a decanter of water. What eat can a molecule retain after an eight minutes apid flight through nearly one hundred millions of miles of cold space, afterwards through the icy lens nd cold water. Instead then of insisting change by olar matter is the consequence of solar heat, it should be inferred, that, burning, exploding and charring generally, are mere mechanical effects as independent of heat as of the feeling or sensation.

All change on bodies imputed to Physical heat admit of illustration on mechanical principles. The System being constructed on mechanical principles its parts cannot be otherwise, nor is there any good reason for supposing the Universe is conducted on a different principle: the simplest manner and fewest means should form our ideas on this sublime subject. Cause is pressure, substance mere atoms common to every thing, and change altogether but local; while of the whole we know nothing but what is, as it were, delineated in the Mind in a species of mere shadowy information, from which nothing of substance can be known but that it is unlike in all respects to what by it we do know. We know but sensations of which heat is one and of the whole nothing resembling a sensation can by possibility exist out of the Mind.

The erroneous idea that fire is hot, arises from the sensation or its like being imputed to its remote cause, and is enforced by the mistake that fire imparts the matter of heat to the animal frame and all bodies in its neighbourhood. The contrary however is the fact in both instances. A short view of some of the effects promoted by fire may be stated without greatly anticipating. Fire promotes loss to bodies, so much so that it is said to "consume them to ashes by its heat." The loss, at first, which bodies experience allows admittance to the expanding medium, as when we take away earth from a river bank water enters, but which is kept out until the removal is effected. The matter displaced in the medium of fire being necessary to the solidity of the body, its loss and the addition of the expanding medium converts the body so as to cause its elements to constitute a fluid. Heat is in nowise concerned. When the fluid is taken from the fire it acquires matter similar to what the solid lost, which displaces the expanding medium, external pressure follows which promotes contraction and the solid state is restored. After this manner all change by means of fire from the solid to the fluid and aeriform state is effected without the assistance of caloric or heat. It is not from any thing communicated by fire, for fire imparts nothing to bodies, that expansion is promoted; neither does the hand acquire any thing from the fire, it suffers loss like other things exposed to fire, and the feeling excited in consequence, together with expansion being promoted by fire, makes it be thought the hand receives heat. The feeling is by the Mind not the hand. Excitement of the brain is independent of heat and so are all mechanical operations notwithstanding fire is indispensible. Fire in facilitating decomposition is but a minus pressure agent: in it a body is under less external than internal pressure, hence its expansion, decrease of solidity and ultimate dissolution. There is not any thing more misleading in Philosophising than the general opinion that fire is hot and heat a physical cause. When this becomes admitted and the principle maintained that physical heat is as montrous as physical cold, shadow and sound, it must appear evident that every experimental result has been erroneously accounted for wherein fire is concerned.

Animal heat, the feeling which is all we know of heat and in which alone heat consists, so far from the means of exciting it being hot, is promoted in numerous instances in the absence of fire, as by violent exercise, angry passions, and ardent spirits which seem cold to both hand and mouth. During bodily indisposition we feel fever heat among the snows and cold before a fire, which proves how little material heat and cold are concerned in promoting these sensations, the extremes of climate, and also thermometric changes. We beat our hands against our sides and rub them together, as if to remove cold rather than acquire heat. Cold is admitted to be feeling only, and it will be found and admitted that heat in every instance is also but our own feeling excited in the Mind in consequence of the nerves of Sensation being disencumbered of elementary matter which prevents their exciting the warm and which promotes the cold Sensation. In every instance wherein the sensation of heat is excited without fire, it is similar to the sensation by fire, and as fire abstracts elementary matter every act which promotes the feeling of heat does so on the same principle.

In the most frigid clime, if we place our body between furs or blankets, in a snow hut where there is neither fire nor flame, we feel warm as when before a fire; we fall asleep and become much warmer. Upon waking the feeling somewhat declines. Whence, it may be asked, has the heat been derived. The Atmosphere, which retains unmelted the Polar snows, could have imparted none, and furs and woollens are so devoid of heat as to be employed to keep ice from melting under meridian Sun in tropical climates. Under such circumstances where is the physical heat to communicate to the body. In figurative language the proposition may be thuswise solved. Heat is a species of animal manufacture, completed in the mind by the Machinery of the Senses. The general pressure constitutes the Power; respiration the process of refining the crude material; exciting the brain the finishing operation; and the resulting sensation the tissue wrought. Respiration is in part a species of pumping process; it throws off matter of impediment to the action of the nerves on the brain, and non-conducting cloaths prevent the return of the like matter through the surface of the body; both maintain the animal frame in a deficient state as respects cold promoting elementary matter. Sleep promotes this deficient state in a greater degree; hence the warmer feeling declines when the state of sleep is over and we become comparatively chilly. From which it is obvious the bed cloaths could not have imparted heat or they should continue to do so; and as the warm feeling is similar to that promoted by fire, the mental effect is equally independent of communicated heat by respiration, according to the foregoing circumstances, as by fire.

While it is conceived fire radiates heat to the hand and surrounding bodies nothing of radiation takes place; fire has no ability to throw out any thing from itself; in itself it is as inactive as all things constituted of inert matter. The hand receives nothing from fire, it suffers loss as do wood in charring, paper in scorching and coal in wasting by burning. Because bodies immersed in fire are expanded, it is imagined they acquire heat which produces enlargement of volume, and because fire is considered hot it is concluded the hand acquires hot matter from the fire which it feels: but as pain excited by fire is only tortured consciousness so heat is nothing belonging to or emanated from fire; and as the feeling principle, the Mind, cannot be said to extend to the finger's ends, neither is heat felt by the hand. Without the nerves of sensation there is no perception of heat and with them their exciting the brain would be unnecessary did they or the hand feel.

To be fully aware of what heat really is, we must reason otherwise than by our feelings, mathematical diagrams and thermometric changes, none of which afford data whereby to know the actual state of bodies. Mathematical demonstration and numerical calculation cannot determine whether fire be hot or devoid of heat, any more than of the appearance of invisible things. Mathematical reasoning on diagrams in proof of the nature and state of bodies, before the physical fact has been otherwise ascertained, has made abstract truths been received as physical facts proved; whereas there is nothing proved but what relates to lines and angles. It is not in this noblest of the Sciences to prove even the existence of Matter, although it has been made subservient to the establishing as physical facts and causes, heat and light, gravitation and chymical properties, and to stamp on Matter generally a host of self-acting properties incompatible with the nature of our knowledge and the inertia of Matter.

Our feelings inform us nothing of fire being hot, nor our reason but that it cannot be similar to the sensation of heat; the information is wholly negative. By the thermometer, degrees of expansion and contraction of the fluid in the tube are all we know, to produce which, substance, not temperature, is required. Elementary matter forced into the fluid enlarges its volume, and when forced out leaves it of altered volume, whether the matter were hot or cold or neither; how these changes are brought about without physical heat or physical cold is the truly scientific question. When the fluid is expanded it has acquired something, for the entrance of which, it is inferrable, it had previously lost something: to promote this loss is what is effected by placing the thermometer before a fire, for all things suffer loss by fire and fire communicates nothing. These and all other hitherto cases slightly alluded to are more fully and I trust satisfactorily explained, each under its respective title, in the following portion of the present work,

Heat being considered universal in Nature and latent in bodies, at the same time appearing paradoxical that it should be evolved from such bodies as Water, Ice and Gunpowder, has given rise to numerous different theories, none of which take notice of the manner the knowledge of heat is acquired and the unheatable nature of matter, circumstances which cannot fail of producing the conclusion that heat is altogether mental, against which there is no appeal. Of the whole, the theory of latent heat is the most opposed to common sense and almost sufficient, when properly appreciated, to make every one, so generally has it been received, think humbly of his understanding in giving such implicit assent to the anomalous notion of heat being withont heat. Certainly much indulgence is due to the little experienced in philosophic lore, but how the acumen of the Illuminati could have been so greatly bewildered is surprising. The time, it is to be hoped, is past, when, had Professors announced the Physical existence of Motion,—which is already maintained by the proposition to ascertain the quantity of motion in the system,—and asserted that at the beginning God created a certain quantity of motion, of sound, time or latent luminousness, mathematically supported as those of physical heat, light and attraction, theories of the kind would have been received and become for a time established. Thus, the quantity of cold heat in Ice, and sensible heat in ignited bodies; how much of the latter is radiated in a given time; the constituent rays of light, their reflecting, refracting and chymical properties, are mathematically ascertained with more than Demoivre precision, when in physical Nature both heat and light are perfect nonentities: nor is the sensation of light in any instance excited by radiant matter, by the eyes receiving rays of any species, or by other means than a quiescent medium promoting, optically, various degrees of colour exciting pressure on the retina, thence on the brain.

On the whole, it is rationally evident no change promoted by fire should be attributed to fire being hot or material heat. The matter of fire is incapable of being heated. and were it naturally hot the quality would be incommunicable therefore useless. There is no more heat in fire than noise in the air, or than luminousness in the substance of a candle and pitch. Heat is but a sensation, an item of knowledge in the Mind, a sense excited state of consciousness. Therefore heat is not the cause of combustion, ignition and decomposition, and these phenomena should be reasoned on independently of the Sensation. Solar agency, while it effects the like changes on bodies and in the mind as fire, is incapable of altering the elementary substance of bodies. Like fire it promotes combustion, expansion and decomposition, during which matter is acted on mechanically only; the general pressure is the motive power in every instance of bodily change, there is nothing alterable essentially that is material; but as while physical change is being promoted and the elements of bodies set free we have different sensations excited, and as we are led insensibly to imagine our sensations represent their causes precisely as they are, we conclude that solar matter is hot and all change by fire the effect of Physical heat. Hence even the term, heat, should be expunged from Physical Philosophy as being eminently conducive to error : it is applicable only in cases wherein sensation or health is concerned. So that notwithstanding the perfection of modern science, as there is nothing in Nature of material heat, it has yet to be discovered, what is considered the simplest of all cases and understood by the simplest capacity, the cause of water being made to boil by fire ; why fire melts ice to which it communicates nothing whatever.

Those who familiarly judge of fire by the feeling it promotes, will naturally ask, if the fire be not hot what is it, what is in it which heats the hand, burns the fuel and boils the kettle ? In reply it may be said, the fire itself is unknown to us, we neither feel nor see it : it promotes a sensation which we imagine is feeling culinary heat and from which it is concluded the fire is hot. The feeling is all we feel, which informs us nothing of the fire, nor can any judgment be formed of it with correctness but that it cannot be similar to the feeling. There is nothing in the fire but common unalterable elementary matter, the same in the state of fire as when in that of the unignitedfuel ; and it makes us think it is hot and red because when its elements are set free the nerves of sensation of the feeling and seeing senses are peculiarly impressed by reason of the medium immediately in contact with them being affected by the disengaged minus pressure elements of the fuel; there is nothing communicated to those nerves, altered pressure is the sense-acting cause. The fire destroys nothing, it consumes nothing. It only promotes dissolution: it is rather a common solvent of bodies, leaving their atomic substance wholly unaltered. It promotes the boiling of water by what the water parts with, and by what it acquires of the cause of expansion. Boiling is mere ebullition depending on abstracting and expanding processes. In this not natural state, with an excess of the expanding cause and a deficiency in other respects, water promotes the sensation of heat in proportion to its deficiency, by abstracting from the hand to supply itself with the like of that of which it is deficient, as will be shown under the article expansion.

It will be questioned likewise, in consequence of the denial of heat in fire and objection to all use of the term heat, in reasoning on physical change by fire, how are we to express ourselves when fire is the object of operation or subject of direction and conversation. In kitchen affairs particularly has the Cook to be instructed in the nomenclature of Philosophy in order that she may understand her more learned Mistress and be to her intelligible; and wherein consists the substitute for the term. The answer is, in common parlance, in house and wordly affairs all required in expression is mutual intelligibility, for which conventional language, however inappropriate in philosophy, is sufficient and with which it is impossible to dispense. To know as is known generally and speak accordingly, so as to direct and be understood, to buy, exchange and sell by a common standard of meaning, the accustomed phraseology is all we need. Nothing but equal learning throughout all classes of Society can displace popular terms, phrases and language in daily affairs and substitute the language of Philosophy, which should be that of Nature. Worldly language must be maintained, as Society is now constituted, in worldly concerns. But in Philosophy it is otherwise. Whatever expresses the contrary of the fact as it exists and takes place in Nature, is inadmissible. Cause and physical effect cannot be alluded to in terms which apply to nothing but sensations. Facts, when rationally deduced from correct principles, will always supply appropriate terms and expressions, correct such as are inappropriate, and without in the least circumscribing popular language in the every day transactions of common life affairs. The terms and phrases in Heraldy, Botany, Geology and the Arts are no hindrance to these subjects being conversed on in popular conventional language:

neither should the precision indispensable to Philosophy make the slightest alteration in modes of speaking on mere popular subjects and those of domestic concerns and social communications.

I have here to mitigate the force of the expression made use of at page lvi, "that all sensations are promoted as pressure on the brain, by the contents of the Nerves of Sensation, is more or less lessened." For although all the Senses promote reduction of pressure on the brain and thence sensations in the Mind, yet by the nerves of the feeling sense sensations are promoted by their contents being subject also to increased pressure. The sensation of heat depends on the pressure of the nervous medium being increased, also the sensation of pain by fire, which will be made appear when treating on fire, or expansion by means of fire.

CHYMICAL SCIENCE.

No Philosopher has ever yet attempted to define the term *Chymical*, or say in what a chymical property consists; notwithstanding chymical properties, chymical nature, chymical combination, chymical action, chymical effect, chymical attraction and chymically saturated, are expressions so frequently made use of by all. To the practical Chymist they are of the first rate service in accounting for the result of his manipulations, and he adopts almost no other in devising the *rationale* of how his manifold productions are effected. To the unlearned person, chymical cause and effect, particularly chymical preparation and chymical mixture, are expressions stultifying to his understanding, and conceived almost to mean the formation of something out of nothing by the mysteries of chymistry: he patiently waits whole days for a chymical mixture of, water and something, as for the fructifying of a germinating seed, and when cost is concerned pays highly for his ignorance of *chymical preparation* at the *Boutique;* over which in significant order stand the side-by-side Pestles representing the *ne plus ultra* of—what you please.

The most learned can attach no distinct idea to *chymical,* nor explain what chymical means otherwise than negatively. The Student in book knowledge, from having learned that matter is of a common nature, and conceiving that what is essentially inert is possessed of no self-acting properties, is led to think chymical nature and properties mean something out of or additional to Nature.

In accounting for results in the Laboratory of Art, the Chymist has no general cause, but refers to a host of chymical causes, properties, affinities, compound affinities, attractions, elective attractions, and chymical energies; while the really Natural Philosopher, in reasoning on the scale of nature's grandest performances, the heavenly bodies and their evolutions, never refers to anything of chymical cause, chymical impulse, chymical change, or chymical effect; yet the matter of the Planets is nothing different from that of the minutest bodies.

What are chymical properties and qualities in atoms of which they could make no use. All atoms being inert, chymical or essential action is out of the question; and the whole of atomic matter being unalterable, essential or chymical change is physically impossible. True philosophy accounts for all change on general principles and has no really natural basis but that of the inertia of matter. Chymical causes and effects are but *ipsi dixit* suggestions. What chymical properties are, should be made appear, or a set of anti-chymicals and latent-chymicals may be started and adopted in their stead by some peculiarly patronized enlightened Professor. To know what chymical properties are, should be ascertained before physical change can be accounted for with any degree of certainty upon any principle. It is not philosophy, that which is indifferent to cause and adopts for cause what is not common to matter generally; much less that adopts as cause what is neither material nor immaterial but a species of attribute inconsistent with the nature of that to which such attribute is imputed. Neither can the most highly learned, whose philosophy is of this imaginary nature, be said to be a Philosopher. To assert what is not naturally true, what is repugnant to the nature of matter and contrary to first principles, and be indifferent to cause, is philosophising more for profit or a name than knowledge and the diffusion of knowledge.

The term chymical is applicable to nothing in nature; physically applied it is as unmeaning as, affections and sympathies of matter: it implies cause altogether visionary and nominal, and is merely a professional term. If any idea could be formed in the case, it is, that chymical means not physical, and chymical action not mechanical.

It being according only to the Chymist's own ideas that matter acts on matter chymically, the term should be confined to his mere professional calling, the science of which at present is that of an Art founded on but imagined principles and the popular "Evidence of the Senses" doctrine and made greatly complex by its numerous arbitrarily assumed unreal causes. As by mechanical is understood physical effect by physical means, by chemical, can only be conceived action by power not substantive emanating from atoms which other atoms acquire and by which they are affected: it is in fact the transfer of essence, productive of essential change on unchangeable atoms independent of physical impulse; it is physical effect by what is not physical. For the origin, heraldic symbols and history of chymical cause, all reference is to Chymists themselves, there being nothing out of their profession chymical in the System. Chymical is neither Natural nor Philosophical, and the term has no claim for adoption or maintenance but in its ambiguity.

Astronomical phenomena, wherein the common cause, impulsive pressure, is productive of motion, are accounted for independently of every thing chymical, but which could not be correct were matter chymically endued, for what belongs to the atoms of matter is common to the whole of matter, should be considered efficient wherever matter is, mostly so in the largest masses of matter. Elementary matter being inert is necessarily homogeneous; hence its atoms are common for the formation of all bodies great and small. That nothing of chymical elements exist, is made manifest in the atoms of the elementary products of bodies being alike although one body is said to be chymical another not so. Chymical properties cannot belong to a body which did not belong to its elementary atoms, neither can the combination of atoms produce any such properties. Then, as all bodies are wholly constituted of inert atoms, wherein consist their chymical properties. Could atoms or molecules be fused so as to become amalgamated; were they miscible so that essential qualities of different species could intermix, neutralise each other, or be productive by intermixing of some different essence, to such the term chymical might be applied: but when all Nature cannot alter a single atom any more than destroy or bring one into existence; and, when active essential properties can in-nowise belong to what is essentially inert, it is all imaginary, unreal and untrue that any thing of chymical cause exists or chymical effect takes place in any instance whatever: yet on such is Chymical Science based and conducted. It is this imaginative system of reasoning on physical change, said to be peculiar to minor phenomena, induced the celebrated Berthollot to assert as a chymical axiom, that, the essential quality of a compound is the mean of those of its constituents; as if the atoms of a body could part with their essence and the whole uniting make, as it were, one spiritual essence, having some predominant foreign characteristic or property within the newly formed body.

That the whole of the reasoning chymically on bodies is fallacious and untrue; that there is no action, communication and intermixture of essence, quality or property between bodies and their atoms is evident, from the elementary atoms constituting the product of a decomposed body being the same in all respects as before they were combined in the bodily form. Thus, the oxygen and hydrogen obtained from water, are the same of which the water was formed; previously to which they might have been obtained from bodies said to be of different chymical natures and very different from water; yet when again recombined as water and again set free, they are still the same unaltered gases therefore atoms. And that nothing of interchange, intermixture or neutralization of chymical, that is, essential qualities or properties, takes place is evident, by it being impossible the atoms could regain those properties and qualities from each other so as to be evolved in every case not only in their former but primeval essential state.

Not satisfied with the numerous unproveable, assumed properties attraction and repulsion, Chymistry subdivides attraction into different species, each of which it assigns partially to this or that kind of body; such as the attraction of cohesion, chymical attraction, capillary attraction, elective and compound elective attraction, together with the subordinate attractions, affinities single and double, and affections of matter; as if matter were as various as names; as if atoms possessed exchangeable sympathies; and as if there could be any affinity between the atoms of matter other than that of atoms for interstices formed by other atoms. The affinity one atom has to others is but such as that which a brick-bat has for a hole in a wall.

When it is evident how perfectly inactive a stone is while lying at rest on the ground, it is obvious, that, as the sum of its atoms is devoid of potentiality neither can the integers be possessed of self-acting properties; yet two bodies equally circumstanced are said to be acting chymically on each other when in contact and at rest.

Who can deny inertia to unorganised inanimate molecules. And as chymical properties cannot be independent of matter, what are they and by what can they be employed; combination of atoms cannot originate any such properties and what is inert is without power to make use of them; which applies equally to repulsion and attraction as to chymical properties. It lies with the Chymist to show some corroborating instances of undeniable proof that quality is something distinct from substance which an atom possesses; that it is transferable and receivable; wherein the power to transfer it lies; and how this accords with the inertia and unalterable nature of the molecules of matter. Also, in what does that chymical attraction consist with which a body may be saturated to the hindrance of it acquiring more. To the Chymist, who is constantly adding to his catalogue of chymical causes and chymical agencies, it belongs imperatively to advance undeniable proof of the existence of properties of matter not physical, or demonstrate that nothing but chymical properties can he productive of such and such results; or else his Philosophy from having no support falls to the ground. What explains nothing naturally and which is in contradiction to the general principles and procedure of Nature, is not Natural Philosophy but the common reasoning of the mere Artizan systematically arranged and classified. There is nothing more easy than assuming causes, excepting it be the adopting the like which celebrated experimental Chymists have previously assumed, because of the difficulty in the way of proving the contrary and experiment being considered the great revealer of Nature although ever mute as to cause. From the general practice of referring to what is now termed Chymical, as being Natural, the Science of Chymistry is altogether but Artificial Philosophy, yet without denying its utility.

It cannot be considered in any other light than that of a blunder and one of the greatest magnitude, the oversight of Chymists in commencing with *bodies* to prove the nature of *matter* or rather the different natures of matter, and make known causes; instead of commencing with *atoms* the sole elementary constituents of bodies. To establish what bodies are and do possess, the proof lies in showing what atoms can and do or do not possess, bodies having nothing in their composition but atoms.

It is most strange to hear the laboured illustrations of natural circumstances in a chymical lecture room, wherein the Professor puzzles even the memory of his hearers in a language and with terms expressive of nothing natural and almost beyond supernatural, certainly foreign to Nature and inconsistent with first principles, at the same time most fluently delivered: how, "the bodies in hand have peculiar *affi-* " *nities* for each other and for the *acidity* of the men- " struum into which they are going to be immersed: " how *chymical action* begins by reason of the bodies " and menstruum *acting chymically* on each other: " what different *simple* and *compound attractions* have

" already taken place: and now, from certain *elective* " *attractions having been saturated* the bodies are no " more the same, but one new body is formed from both " becoming *chymically combined.* That the new formation is of an entirely different *chymical nature* " to either of the former, it having less of *latent heat* " than either and having parted with much of the " light of both for which it has no *affinity*. That by " the thermometer it is evident several degrees of " *latent heat* have become *sensible* in escaping; and " we have the *evidence of our senses* for light ceasing " to be *chymically combined*, And now I am persuaded none of my hearers can doubt the wonders that " Chymistry, by simplifying facts, has effected within " these few years in making known the *precise* manner Nature performs her most secrect operations, " which, without the lights of Chymistry and the immortal Minds of the indefatigable Discoverers would " still be unknown to the approving and and admiring " world. By our *Senses* we could only know *what* " *matter is* and its common properties attraction " and repulsion; whereas by *induction* we learn " *wherein its chymical properties* consist: how matter insensibly acts by *chymical energy* on its like " is made evident to both sense and reason,"—and, according to the rank of the Professor, is the amazing ıpprobation and wonder at one small head containing so much *palpable* knowledge. Thus it is the Lecturing-chymist amplifies on the Nature of bodies leaving that of their atomic substance unnoticed and most glaringly perverted; as if bodies not their atoms were primevally formed, and as if essential qualities and properties germinated out of atomic aggregation. Throughout the whole there is nothing according to Nature, the entire is assumed and untrue. The "Evidence of the Senses" fallacy and metaphysical causes, together with newly discovered results, produce and comprise almost the entire of Chymical Philosophy: the inertia of Matter, the key stone of Natural Philosophy, is entirely overlooked or mistated, and the General Pressure, the only cause in Nature, referred to only to answer some few incidental purposes. Nothing of a general cause is maintained; almost every case has some cause for itself; by which matter has as many assumed causes to keep its atoms in a state of local change as it consists of atoms. Whereas from bodies having nothing of what is sensibly known by them, matter being inert, local change all it can undergo, and impulsive pressure the sole cause of action, how very simple is the *rationale* of every result imagined to depend on chymical affinities, properties, energies, causes and qualities. Thus, it may be said, two bodies when thrown into a menstruum become one, in consequence of the menstruum being a minus pressure medium to their atoms, which by leaving the bodies under greater inward than outward pressure dissolution follows and elementary matter is evolved; and from some of the evolved of both bodies becoming compressed together a different body is formed which constitutes the result, name it what we will. There is nothing in the case the like of any of our sensations, light, heat and acidity, nor any thing imputed to matter inconsistent with its natural inertia. And here it is philosophising on physical phenomena has its true commencement on the broad basis of the Inertia of Atomic Matter; which refers all cause of change and formation to the pressure under which every thing exists, and without which nothing could take place. As one Element is to some other a minor pressure means, and as different elements enter into the constitution of every kind of body, a minus pressure medium or menstruum promotes dissolution and intermixture, and the common pressure is the motive power in causing interchange and recombination. Throughout the whole of the decomposing and composing processes there is nothing chymical, metaphysical or of attractions concerned, there is nothing of menstrual corrosion, nor of atoms being induced to fly out of bodies into each other's embrace from a species of natural hereditary affinity. The whole is but mechanical, operation and product.

Nor is it confined to Chymical Science the adopting fictitious causes. The Faculty maintain that causes and laws connected with animal organisation are different from those by which the rest of Nature is actuated. But why should the learned Profession magine these differences in a System the parts of which are all composed of the like common matter. Yet it is maintained there are peculiar Elements for the formation of the animal body or its laws would not be different from those of matter generally. This however is at once denied, by the gaseous product of a decomposed animal being like in all respects to that obtained from the decomposition of sticks and stones, What are flesh and blood, nerves and muscles, the heart and brain, as respects their elementary substance, different from the food from which they derive their matter of increase; or it from the vegetable bodies the substance of which is contributed by the air ultimately and to which the elementary matter of all things reverts: otherwise the animal organs should consist of as many different kinds of elementary matter, not common to other bodies, as the frame includes dissimilar solids and fluids. The body being kept in its living state by food and air only, and the whole becoming in time air again, there is no reason whatever for imagining emanating laws or acting cause other than the like, in the living body as in all other physical cases. The great mistake lies in identifying the mind's perceptions with the organs of the body and making sensations causes.

If the sensibilities of our Nature and the powers of volition with which the Soul is endowed be set aside, and the ever unaccountable miracle of produced organisation be left out of the question, what is the substance of the human body different from the common matter which everywhere abounds. And in what are the functions of the animal organs evinced but mastication, decomposition, conveyance and deposit of the elements of the decomposed food; the forcible flowing of the blood and mechanical contraction of the muscles, all of which require but pressure to effect and minus pressure matter to promote: motion is the effect, deposit the result and pressure the cause. The animal physiology exhibits a system of parts perfectly mechanical, wherein part is united to part, although differently from those in machines of art, and each dependent on another as well as on the general pressure for its operations. Pressure being removed, all animal functions must terminate, therefore it is not less essential towards keeping the bodily organs in action than the force of wind and steam to keep machinery in motion. So that until it can be shown the human machine is constituted of elements essentially different from those of unorganised bodies, can it be admitted that its functions, even where volition controls, depends on Cause different from that which is universal. But nothing of partial cause or isolated laws can enter the Mind of him who has a just conception of elementary principles.

LIGHT.

Light, consisting in rays, is said to flow from the Sun and fill the air, to cover bodies which it illuminates, and which, when reflected from their surfaces into our eyes enables us to see those bodies. It is said to consist of several different kinds of elementary matter, the atoms of which are so infinitely small as to be capable of passing uninterruptedly through the densest pelucid bodies; that its rays are emitted from the Sun so copiously as to proceed to the Earth as well as supply all the planets in the solar system and with immense velocity but without any momentum; that some are rays of colour, others of heat, others of a chymical nature and others endued with the property of polarising bodies; and that those of light and colour are unequally refracted during their transmission through different media. Yet while all this is maintained in opinion and supported by mathematical demonstration, it is at the same time doubted by many whether light be any thing material. Eventually it will be found light is but a mere sensible effect; that there is nothing of material light in Nature; that light consists in a sensation, the cause of which is neither luminous, coloured, nor emitted from the Sun.

That there is no elementary light in the System is made manifest by a number of well known familiar circumstances. First, where is this substantive light; can it be seen, collected, weighed and confined, and although said to be given out from bodies during combustion, wherein is its luminousness evinced when within them. What can destroy elementary luminousness; or, is latent luminousness as philosophically understood as latent heat, and then latent sound has equal claim to adoption. Light should be known in whatever it exists, but what can retain that to which rock crystal is not impervious, and all bodies are porous. If it be said that opaque bodies hide their included light; this cannot apply to a hollow glass globe which in open day is said to be full of light, but which, when suddenly removed into the dark, is instantly empty of light; and there is no escape of light into the dark or it would be sensibly known. Can any one look but half way through a room on light in the mid-air; or what in any instance is perceived but some terminating object, as is generally conceived, which in fact is only thc sensation of colour, promoted by the body or object, which sensation, from being apparently before the face, is imagined to be thc body itself looked at and seen by the eyes. That there is no element of light in Nature may be considered evident from the following instances: First, why should it disappear suddenly and insensibly, as above stated, when in the dark it would be most conspicuous. Next, what has become of this six thousand years flow of light from the Sun into the Atmosphere, when at the present day one hemisphere only can be said to be full, but which when turned from the Sun is almost instantly dark. Why are not both hemispheres at once full from flow and overflow, when one is said to be full a few seconds after sunrise. If one be full and receiving hourly more and more, what goes with its contents when the great cavities of the Earth are dark and there being no emission of light from the globe or atmosphere. Were there endless flow from the Sun, neither night, shadow nor darkness could take place on the Earth by reason of the Atmosphere being as a completely and permanently filled reservoir of light, light possessing no ability to fly off nor the Earth to throw it from its surface. So that from there being no equilibrium, overflow or escape, nor light within the bowels of the Earth, and from visual objects being but excitements of the Mind by the senses and not by light, there is no foundation in fact or reason for the notion that light is material, notwithstanding all the mathematical demonstrations and all the chymical phenomena attributed to this and that ray of solar light. As well might the chymical nature of the sensation of luminousness and of colour make display in Philosophy as do the wonders imputed to the nonentity denominated physical solar light.

Light, to which the most dense crystals are said to be pervious, is unknown during a mere permeable fog. In which case the clouds should be super-illumined by the detained solar light and not add to the darkness of the day. If so large a space as the area of a Church be full of light, what goes with its contents when the last window shutter is closed, which makes all within be in darkness instantaneously. To say the light escapes through the roof, floors and walls, is refuted at once by it being far more reasonable the flow should be from without into the building, from the source and flood into the estuary, from the plenum and while equally free to flow inwardly as outwardly; otherwise the flow is only from within into the plenum, leaving, as respects the supposed matter of light, a self-formed vacuum behind and without any hindrance to it being a plenum. So far then from known circumstances it is manifest physical light is a name for nothing, and we must seek for other means to account for visual perception, more consistent with the functions of the optic sense, than solar rays and the illuminating of bodies by light which nothing can make visible, particularly as covering them with any kind of matter, supposing the eyes could see, would render their visibility, if any, much less.

De Cartes says, that light reflected from bodies and entering the eyes, could make nothing visible but light: still this is on the erroneous opinion that the eyes see and the mind's perceptions are external objects of our eye-sight.

Newton's light consists of atomic matter that flows and is reflected in rays, "some of which a body reflects, others it absorbs, and the absorbed portion from being repeatedly refracted within the body becomes lost." Can this be considered philosophic; inert bodies at rest impelling matter from their surfaces; matter becoming lost, particularly luminous matter that nothing could render otherwise and indestructable matter made for endless purposes. For rays to arrive at the Earth it should be shown what impels them, there must be a cause: to say they are emitted by the Sun is assuming a solar property foreign to inert matter, at the same time leaving the imputed power of the Sun's attraction, which would prevent emission, wholly in the back ground and out of the question. Reflecting of rays by bodies at rest is equally foreign to inert matter as self-motion; matter becoming lost, is as the child's excuse for not finding what it says has gone astray.

It will doubtless be said, that, as we do not see in the dark, vision must depend on external light. The fact however is, that, as seeing is but perceiving a sensible effect optically promoted in the Mind, and as the effect itself is nothing luminous, it would be as useless to have bodies we cannot behold surrounded with light, as lamps in the Mind to make the sensation of colour visible to the Mind. Light being but a sensation can have nothing similar for cause;

so, from there being nothing of light or luminousness outside the eyes, it is in the dark at all times we do see: we are situated in the dark during the excitement of every visual perception. A person standing in a place admitted to be dark, in the shade, says, he sees all things beyond the shade, he sees through and looks out of the dark. A person situated at the far end of a long darkened room having a small open window at the opposite end, says, he sees the outward landscape through the window, while to himself his hand is invisible owing to the surrounding darkness. That this is seeing in the dark is manifest. But, it is said, in this case only so much rays of light came to his eyes as are sufficient to compose a likeness of the landscape on the retina. This dogma is refuted by the landscape being known, as before, while the Spectator walks across the room with his eyes directed towards the window: from which it is obvious there is as much light in one part of the room as another; and the constant flow into the room should in time fill the entire space between the distant opening and the Spectator. If the Spectator turn his back to the opening and direct his eyes to a mirror on the wall, the landscape is known to him as before and without light being either in the room, on the wall or frame of the mirror. How then can it be maintained he sees in the midst of darkness by means of rays of light entering his eyes. If a person direct his eyes downwards towards the bottom of a deep Mine, he says all beneath is involved in deep darkness; but if a bucket of water be introduced at the bottom, he says he sees in the water the stars, which are above and behind his back the same as when his eyes are turned upwards. Let him think as he will the stars are not in the water; and however the visual mental effect is excited from which it is imagined the stars are objects of eye-sight, it cannot, under such circumstances, be by means of rays of light reflected to them which do not lessen the darkness in their passage downwards to and upwards from the water. Neither could the water reflect rays which are said to be transmissible through that fluid. Light is said to pass uninterrupted through water, and a yielding medium is not capable of effecting reflected motion. So that it is all imaginary seeing by means of receiving from the remote body rays of light. This again is seeing in the dark according to commonly received opinion of seeing being an occular faculty.

Could any outward thing be seen by the eyes from light being reflected into them, it would doubtless be the reflecting body, and then the seeing ability would require only that the body should be illuminated: but how the eye stands in need of light, if it can look and see abroad, is inconceivable. It is the water and not the stars that should be seen upon looking into the mine; but seeing the stars by looking at the water, is like looking on the ground to see the Sun; and seeing the stars through darkness, is certainly seeing them in the total absence of rays of light.

Did solar light reflected into the eyes—as that from the stars to the water, thence back to the eyes, is said to make us see the stars—make us see the body whence it proceeds, we ought to see the Sun in every direction of our eyes during day-time.

The moon's image on water is said to be seen by reflexion. What is reflexion? Is an image formed on the water and reflected into the eyes: of what is the image formed? If the eyes see an image, why is it here, there and on every part of the water as we walk along the river bank? Seeing by reflexion satisfies all, without questioning the necessity of rays being reflected to the eyes which are supposed to look out of themselves. But as common sense immediately yields to experimental illustrations, all reasoning is absorbed by the theory of image-making rays. What image is formed or known by exhalations; neither by radiated or reflected light could any thing of the kind take place. The expressions, reflexion and refraction, put all reason to a stand and argument to an end. Implicit assent is instantly given to whatever is said to be caused by reflexion or refraction: none ask what has reflexion or refraction to do with exciting a sensation in the Mind, without which being effected there is nothing seen, that is, visually known; but all think they see outside themselves this reflected and refracted light. Then again, it is said, seeing by reflexion is owing to light being so highly elastic that the angle of reflexion is equal to the angle of incidence. But how do these equal angles make the mind, from excitement of the brain, know any thing of the moon's image or the moon itself. All the while it is imagined the object known is known by the eyes; but knowing it by the reflected and incidental rays amounts to looking at it by them crookedly. By light long separated from the moon, what of the moon itself can the eyes, senses or mind know; the reflection or glance of a bullet is no indication of wherein consists the impelling or reflecting power; neither could reflected light be productive of any other effect than what is common to physical impulse.

If by reflected light we see the landscape, while situated at a distance from it and in the dark, then light is not luminous but dark and in the dark it is we see. But did we see by reflected rays, the fact should be evident by all bodies being seen where rays of light have access ; so from the contrary being manifest when we look through the dark, by the nearest things being invisible, while rays of light are said to arrive at the eyes, it is incontrovertible even on this showing alone that vision is not promoted by rays of light.

While by means of a prism it is so confidently maintained white light is decomposed into different colour-making rays, and by a double convex lens these primitive simple rays are again united and the original white light reformed, the fact is, there are no rays to disunite, the visual sense-acting cause is quiescent, and is always present or we could not see out of and into dark places. It is most inconsistent the idea of a coloured prismatic spectrum and one of white light being formed by rays on a screen, while colour is admitted to consist in a sensation only. Newton undertook to measure the spectric colours and calculate the ratio of refrangibility of each with mathematical precision, when according to his own definition of light and colours there is nothing of the kind except in the Sensorium: yet there is nothing more generally admitted than his illustration of the experiment. Which shows not only how easily assent is obtained to assertion sanctioned by authority, but the proneness of Experimenters to make Nature itself as well as first principles bend to human theory. As well might the sum of negative quantities be construed into a positive amount as an intermixture of rays, all less than white, make white light: no common Artizan would advance or assent to such a proposition properly stated. All know yellow is less than white and red still more removed from white, hence both together cannot produce white, how then can they be made white when blue, which borders on black, is added to them. From which it is manifest there is no white light formed by the union of of yellow, red and blue making rays; it is equally obvious there is no prismatic decomposition of white light. Still the greatest difficulty is to persuade Newtonians that Sir Isaac himself could be under a mistake and that this truly beautiful experiment of his could mislead, there being no denying experimental proof whereby "Nature is tortured out of her secrets." Yet were that most highly talented Philosopher now alive, none would more candidly acknowledge his mistake and embrace the truth. His great mind would have looked shame on Professors incapable of discovering errors of opinion from an over obsequiousness to the judgement of any individual however highly talented and esteemed. In Newton existed the greatest genius, the most exalted in talents; one far superior to the age in which he lived and in this by none exceeded. He promoted Science in every branch, enobled and enriched Philosophy, and enabled Philosophers in after times to make it perfect. His Experiments so indefatigably pursuaded and most judiciously performed, require only to be known for the natural fact to be discovered, without repetition and with certainty. But his illustrations are altogether erroneous while his mathematical calculations remain indisputable.

So facinating are prismatic experiments, so perfect the means we possess for promoting visual perceptions, and so persuaded are we our perceptions are outward objects seen by the eyes with the assistance of external light, although evident to none, the theory is by none impugned or even questioned. This and the difficulty of conceiving how bodies could be seen in the dark or without light being present, has left this interesting branch of philosophy not only the least advanced, although Optic Instruments are becoming more and more perfect, but almost retrogading. What can be more so than reasoning on a sensation as if it were radiant matter which the Earth receives from the Sun, which all bodies reflect from every physical point of their surface and by doing so make themselves visible;

when, did the eyes see, nothing is gained by this radiant reflected matter; and not only making the sensation material but imputing to it physical polarising properties, chymical properties, also heat, colour and luminousness.

It is a great mistake, arising out of inattention to the nature and use of the Senses, the air being filled with rays or pencils of rays of solar light and a room with light emitted from a candle-flame. Were light in flame it would be recognised phospherently in the substance of the candle. What is productive of more flame than pitch, yet nothing is more indicative of the absence of light than the dark opaque substance pitch.

Being fully aware of the theological objection in proof of the existence of physical light, I shall with all due difference and circumspection but not without confidence, approach the awful shrine of the Fathers, and rather than leave the influence and opportunity of a misinterpreted word, expression or sentence to stifle all opinion not strictly orthodox, stand forward in defence of philosophy founded in Nature, utterly "uncaring consequences."

Light outside of eyes not made for looking out of them would be useless for visual purposes: nor does the growth of vegetables depend on radiant matter.

Rays of any kind, light or dark can make nothing in Physical Nature visible, and what we do see, Sensations, require nothing of the kind for their being excited. From which it is obvious, the expression in Holy Writ, "Let there be light," could not have been meant literally by the original Writer, or, and on the same Authority, there is material "thick darkness that might be felt."

Literally, let there be light, means, obviously, previous non-existence of light and at the command physical light being created and added to the System; but as tangible darkness is a mere idea, and from seeing being confined to internal sensible effects, neither of the foregoing written sayings can be interpreted, consistently, otherwise than by receiving both equally in a metaphorical sense.

God made nothing in vain, neither designed he any thing of but secondary utility, nor for purposes short of the duration of time, which, from being a natural event is co-existent with imperishable matter unless divinely willed otherwise; but that would be altogether in vain for which a peculiar provision had been designed. The Earth had performed but three revolutions round its axis, according to the sacred historian, when on the fourth the Sun was set in the Heavens to give light, that is, to promote vision—

also to promote planetary motion—"to divide the day from the night;" and not until the sixth revolution or day was Man created. So that before the Sun a peculiar element, such as is conceived of light, was not needed the Earth being without inhabitants; for until the fifth day even the brute creation had not taken place. Nor is it reasonable that light would have been created to serve for three days only and then be uncreated, for nothing of it is now known or has been since the Sun was set in the Firmament, and, visually speaking, with the Sun we are in darkness to this day. Man being organised in harmony with the System in which he lives and of which he constitutes a part, made,—or it may be said produced out of pre-existing matter—formed out of the common mass of matter and to which his body in time returns; depending on the common medium in which he exists for the continuance of his existence, and having his knowledge originated by outward Nature on his mind without any thing for the purpose being conveyed to the sensorium for inspection and without possessing the least capability of looking out of himself, precludes all necessity for and all idea of there being external light created for the purpose of his acquiring knowledge by the visual sense.

To promote visual sensations in the midst of mental darkness we have the Sun as a minus-pressure sense-exciting means for general daily purposes, and in his absence the common matter of bodies generally when restored by the process of combustion to the elementary state. Subsequently to the Creation of the World the creating of a peculiar matter of light and for but temporary duration, would seem as if to remedy a defect or oversight by means useless beyond the moment, a circumstance not possible to have occurred, an idea too impious to maintain.

Of the light said to have been created the first day, there is nothing known during the absence of the Sun; while the Sun is present it would be unnecessary and altogether useless. Had there been any such before the Sun was set in the Heavens, it would have been general round the Earth at once and for ever and the Sun been useless for visual purposes; but as we depend upon the Sun for vision, the non-existence of all other general daily means is evident. There is no day but by the presence of the Sun; the hemisphere not facing him is Night, but there could be no Night were the first day's light in existence. It cannot be maintained the Sun was set in the Heavens on the third day to make day more light than "the first day's light" of both day and night, but to promote vision daily in the absence of all other general means. Of two general sources of light we are ignorant at present, and are led to conceive, most submissively, that what the Creation required was included in the atomic substance at first and at once created. Were there a dozen sources of light instead of one the whole could not make externals visible, and as we see where there is no light present, as already proved, it is conclusive that the creation of physical light is a misconception of the meaning of the text. Hence it is but weeningly bending to words and expressions of changeable import, taking those alluded to in a literal sense. The natural fact is undeniable, it cannot mislead if rightly understood, it being God's performance; whereas written expressions and in the language of Man are liable to misinterpretation, mistranslation and misconception from its various idiomatic import in different languages. All that is, contributes not only to our conservation and comforts, but has been intended for our edification. To mistake is no crime, but not to enquire is an open disregard and direlection of duty, and the most contemptuous return for the gift of our intellectual faculties given by the Great Bestower, and not for his supreme glory, which admits of no increase, but our benefit and happiness. All things are laid before us to know after a prescribed manner; there is nothing secret or forbidden; the possible therefore, it is designed, we should endeavour to know, the impossible requires no interdicting command. Were light necessary to the incipient creation it would from the first have belonged to it. The Author who first penned the expression, "let there be light," in his zeal towards the GREAT BENIFICENT, was expressing human thought in human language, and depicting according to his ideas, an order of Creation commencing at what he conceived the nascent state of the world, just as the Philosopher undertakes to account for the formation of a Planet out of pre-existing matter and the different stages the first combination of matter most probably undergoes towards effecting the completion. The Sacred Writer described from the most grateful overflowing of heart in language to us poetical, what he conceived the order of Creation; but as Newton remarked, we must not refer to it for Astronomy—although if what is written were the natural physical fact it could not but assist as so much astronomical proof—we are justly warranted in bringing forward Nature itself in evidence, that, " Let there be light," equally as " Thick darkness that might be felt," are purely metaphorical expressions conformable to the style of speaking among the Easterns at this day and in the most ancient times.

That other written expressions in the history of Creation recorded in the book of Genesis are metaphorical and figurative is evident from the saying, "I will set my bow in the clouds." For while all mankind imagine there is a visible bow—there being no denying the "evidence of his senses,"—still there is no rainbow in the clouds, nor is there any necessity for one being there while in the mind's perception the Divine token is recognised.

All we can know of a rainbow is the sensation of colour under the idea of it being in a bow like form, and, from the sensation or perception being seemingly in the air, we imagine there is a coloured bow in the apparent place of the perception or "in the firmament." After this manner only can we have knowledge of a rainbow, and not always, the season or natural ciscumstances being concerned in the production of the perception. That there is no coloured bow seen before the face is manifest from seeing being but perceiving colours and colours being but sensations: and that there is no bow of any kind, coloured or uncoloured, in the firmament at any time, is manifested by no two persons out of a thousand, remotely situated from each other, agreeing as to the place on the ground where the limbs of the bow rest, each imagining different landmarks the place. Hence there should be as many rainbows as spectators: but while one only is seen by each, and each bow differently situated, it amounts to there being not even one externally. A spectator sufficiently and suddenly elevated above the horizon would, at times, know the same phenomenon under a different perception from what it appeared when he left the ground. He would not know it as a bow but a complete circle or elipsis, such as on a minor scale is named a coloured ring or oval produced by means of transparent globes and convex lenses. The *rationale* of the rainbow is: the perception is that of colours in a bow like form, and is but a mere prismatic mental effect, excited in the mind in consequence of a considerable portion of the air before the face being in a state bordering on humidity, which permits the line of visual continuity through it being as though a prism, that is, lying somewhat out of a straight direction or in some degree curvilinear, by which the optic pressure is productive of sensations of colours; and, on account of the eyes being spherical the retina is impressed in a bow like form, whence with the sensation of colour we have the idea of curvature. Focal distance is also to be included in accounting for the perception, as doubtless could we ascend to the apparent place of the sensible bow the perception would be changing the whole of the way, and when arrived where the bow is said to be we should neither see a bow there nor have any perception as before. The spray from the waves of the sea cause a number of diminutive bows in the Mind at the same instant, and the like is known by means of a candle and cut bottle-stopper. The jet of water from a fire-engine promotes, of a spring morning, the perception more brilliantly than the air at any time. This bow cannot be said to be in the jet and to have been drawn up with the water from the well; nor is there any bow "seen" if the observer change his situation· The sun and water are equally concerned in promoting the mental phenomenon. The shadows by my pen, now red and yellow, were an hour since yellow and blue; by bending the pen there seems to be a coloured bow on the paper. By my cane there are thirteen coloured shadows, but indistinct, on the wall, and when the cane is bent for the purpose, similar to the rainbow seemed to be on the wall, as would be the case by the prism were it curved. Hence as the like of the rainbow is effected by means of humid air, water and the sun, also without water or even humidity, the whole of which means may be said to have existed coeval with matter, it is conclusive the rainbow, at all times, is but a prismatic mental effect similar to one supposed on a screen. Still, although it is rationally evident there is no external bow, the knowledge we have is to us as one in the Firmament, and to all sincere believers a convincing testimony in proof the truth of the recorded Divine Covenant of God to Man.

The standard of truth is to be found in the Word and Works of God, but even sacred truths are, in numerous instances, humanly expressed in Metaphor and Figure. It should be proved there is tangible darkness before material light can be admitted. Besides, it is obligatory to show that our perceptions are not sensible effects but external bodies perceived by the Organs of Sense and that light and darkness are seen by the eyes; but then we leave the functions of the nerves of sensation an unnecessary appendage to the brain and so much of the Works of the Almighty made in vain. The natural fact however settles the difficulty: there is neither physical light nor feelable darkness in Nature or there are both.

Philosophy to be natural cannot be contrary to the truths of Nature, and its province extends to the utmost bounds of Nature; in the enquiry after which, although all is wonderful, there is nothing forbidden, hidden or mysterious to impiously contend against. Our being endowed with reasoning faculties their cultivation and application are required for the benefit of all. Reason has its limits; it can make nothing untrue founded in truth, nor true which is proveably erroneous: nor is legislative interference required to keep reason from outstepping the bounds of possibility: where proscription interposes ignorance, fanaticism or cupidity lurks beneath. The past we are aware is not entirely gone, its racy influence still maintains a dying grasp at the good things of this world and has popish hold over the human mind, making even Divine Philosophy bend to the dogmatising will of a remaining few. But in this age of universal struggle for the recovery of lost rights and free discussions; in this enlightened kingdom particularly, it is ceasing to be deemed flying in the face of "Our Father" investigating the order of created things, and interpreting, each after his best judgement, the Divine System "against which even the gates of Hell cannot prevail."

In conclusion, it is demonstrative, notwithstanding all the mathematical proof of Philosophers to the contrary, there is nothing of Light in Nature. Light is only a Sensation promoted in the Mind where alone it is of service, in consequence of the optic nerve being made to act on the brain. Nor can any thing inspire us with greater admiration of the Divine

Wisdom and Goodness in the works of the Omniscient, than, that what we require and what are deficiencies in Nature should be supplied by the miraculous interposition of Sensations. The immortal Franklin said, Nature is sparing in her materials, she has nothing redundant, at the same time there is no deficiency. But how much more economical is her plan than the American Philosopher imagined, having neither light, heat, cold, colour, sound, flavour nor odour in her materials, yet supplying the whole in states of sensibility, which answer every purpose of each being part of the substance of the material world.

Were some great Potentate from afar to pay a Royal Visit to these realms, who being devoid of senses but possessed of faculties whereby to know outward things divested of all we know in the form of sensations; capable of seeing them without colours, knowing them immediately without heat, cold, sound, flavour and odour, and being perfectly ignorant of those divinely bestowed mental enjoyments, what state pageant to honour his visit could astonish him so much as the consequence of conferring on him for the while senses such as ours. All with which he had been familiar would be vanished, all he perceived would exhibit a blaze of beauties, a chorus of inexpressible sounds; all he touched, to him has almost living qualities; and to him the viands of the feast would be Ambrosia of the Gods. Withdrawing now the loan of the senses and informing him of the miraculous device to make all things contribute happiness to the mind, how inspired with adoration would he not feel at the goodness of God in blessing us with such inestimable advantages, to the whole of which through life he had been a perfect stranger—to the value of which ourselves are not sufficiently sensible from familiarity and misunderstanding.

Could any of the manifold wonders of Nature be selected showing greater wisdom of design and goodness in the Designer, the addition of the Senses to the animal frame must claim undisputed pre-eminence, which taken only as means of temporal happiness cannot fail when fully appreciated of exciting in the heart of man the most lively gratitude to our benificient Father for this evidently paternal interference in behalf of his lowly creatures; by which He has enabled them to scan his own wonderful works, to know the whole by almost supernatural means and in knowing have enjoyments beyond the whole of nature otherwise to confer. He who wisely ponders on these wonderful endowments, who piously reflects on their being designed to be tributary to his happiness here and the ultimate object of his existence, cannot but feel the most devoted gratitude to the God of love, consider his supreme interest lies in living according to His laws, and in the fulness of Soul exclaim, " How excellent are thy works O God in wisdom and benevolence hast thou made them all"!!!

The Omnipotent Designer might have assigned in bodies devoid of Senses, each a moving whole at the command of will, capable of making our way and supplying our wants without any of the enjoyments the Senses promote. But then we should have no stimulating object of intellectual pursuit, the light of knowledge, the philosophy of divinely formed Nature would be unknown. We should, while in this worlds, be ignorant of the performances and laws of the sublime System and of that Order which formed worlds from nothing but wisdom's word ; we should have no thirst after knowledge ; and when quit of this suffering existence return to the ground as uncultivated as the clod which makes the last covering to the body. Whereas from being endowed with several senses our enjoyments are increased beyond measure, the inlets to knowledge are numerous and the Soul, by every possible means, is fitted for its future state of endless happiness.

Philosophy furthers every divine intent, it opposes nothing that is of God, its subject is the works of God. Its exalted subject teaches wisdom and promotes the benignant will of Heaven. He who bestowed on us the gift of reason and laid open to our view the book of Nature for edification, requires the cultivation of reason, Of our mistakes of discernment He takes no vindictive advantage, neither should we of each other's opinions. There is no impiety in unwilful error : who knows truly the natural fact in any instance : all see as through a stained glass but darkly, and to be of the same opinion in philosophic pursuits all must conform to the prescribed means of acquiring knowledge with which all are endowed. Talent and Time alone are ours, all else we leave behind. To Nature alone can we look for natural truths on which to employ the faculties of the Mind. That we should cultivate the talent and not hide it in a napkin is a mandate indelibly impressed on the vital spark. What then should arrest the progress of enquiry, or who so despicably bigoted as to denounce it infidelity.

The wisely enlightened will candidly admit, that, the more we know of Nature the more enobled are our ideas of the Great First Cause. That true Philosophy promotes uncorrupted religion must appear evident in the principle on which the following illustrations of Natural Phenomena are founded, the principle of Inertia. The half-reasoning Atheist decides where he ceases to know. Because all things in Nature are productions of Nature he concludes that Nature has made itself or required no Maker. But as matter is inert it can do nothing : from which it is evident nothing but an all-disposing hand could have so fitted it as to be in a state of endless performance and maintain the most perfect order. If a heap of stones cannot form themselves into a building, neither can the inert atoms of matter of themselves become even a mole-hill. All things in Nature may be productions of Nature as man from man and wheat from wheat, excepting the matter of the whole, the order in which it is placed to perpetuate order and the almighty spirit which moulds brute matter into organised system. Matter of itself can effect nothing, therefore there is a God that designed the whole and made it what it is.

From the delectable pursuit after knowledge of the works of the Divinity, the conviction is irresistable, that what has emanated from God himself, which pours knowledge into the Soul, makes the Earth a Paradise to the wise and just and thereby advances the will of God in Man's creation, is a certain, although not the only means of promoting VIRTUE, MORALITY, RELIGION !

SPACE.

SPACE through which the Planets revolve, Newton at one time considered a vacuum : Newtonians still maintain this opinion. In support of which it is urged, that a medium in space, however rare, would in time put an end to all planetary motion, and that the smaller the molecules of the medium so much greater would be the resistance by the greater density of the medium. Des Cartes maintained a contrary opinion. He considered planetary motion depending on a medium filling space, but which he imagined moved the planets from being itself in motion. In this last particular the French Mathematician greatly erred; his idea however is more consistent with the inert nature of the atoms of Matter than that of the English Philosopher.

The Newtonian theory, from being founded on the following principles, is evidently erroneous. "A planet continues in motion from impulse once impressed; and a body, after impulse has ceased, can continue in motion for ever, all lets and hindrances being out of the way. The least resisting medium must in time totally destroy the motions of the heavenly bodies. Inertia enables a body to continue in motion after impulse has ceased:"—the contrary of each of which will be found is the natural fact. Motion depends altogether upon impulse, therefore cannot continue after impulse; nor can the effect of impulse, motion, be greater than its cause. A universal medium of pressure is indispensable to promote and maintain the motion universally of inert bodies. A body in motion, even within the atmosphere, is proof of all resistance being overcome: impulse must be greater than all resistance to produce motion: it is the gradual decline and total cessation of impulse which brings motion to an end. The inertia of matter disqualifies a body from being in motion, unless effected by impulse as long as it is in motion. On these principles it is evident planetary motion must have a constantly impelling cause, one filling the space through which orbicular motion is performed.

That space is a plenum is equally certain from the manner the Mind has its knowledge of the heavenly bodies by means of the organs of the visual sense. A star is not seen by the eyes; its presence and relative situation in space are known only by the effect it is accessory to the promoting of in the Sensorium, which depends on the brain being excited, not by the star, but that with which the star and optic sense are both in immediate contact : and the act on the sense can only consist in the visual pressure being altered, in consequence of the star lying in the direction of vision or being interposed in and terminating the axis in vision line. Were there no connecting medium how is the star to affect the retina. Were space beyond the atmosphere empty, the stars could produce no optic excitement ; no mental effect, such as is considered seeing by the eyes the stars themselves, could possibly be excited, and the whole would be unknown to us visually as although there were none in existence.

The pressure on the retina being lessened and the star the remote cause, it is only by these, matter in a state of pressure touching the retina and extending to the minus pressure means, the visual effect is produced. After this manner of sense excitement we have knowledge of a star being before the face, not by means of rays travelling through the regions of space and received in the eyes to make an image on the retina, which could not inform us where the star is nor where it was when the journey commenced.

Some imagine we see a star, merely because it is present, with the lenses of our eyes: but no theory of vision is without a sense-exciting cause, one that impresses the retina and has proceeded from or is in connexion with the external body. But as only by changes of pressure on the brain can visual mental effects be rationally accounted for, so by a quiescent medium subject to change of pressure, alone, can a remote body be instrumental in affecting the retina, optic nerve and brain.

As then, planetary motion, also mutual effects promoted by planet on planet, as well as visual perception being such as can be accounted for with consistency and rationality on no other principle than that of impulsive pressure, which is all sufficient for the whole of these purposes, the inference is uncontradictory that space is a plenum. Which agrees with the opinion of Newton in his letter to Bently in his latter days: it is impossible, he said, one planet could affect another—by attraction—were there nothing but empty space between. Which is in fact admitting, that, as by physical means planets can affect each other and the means not less than universal, so universal attraction—which makes a star by acting on atoms, make these act on the next attractively, and so on for a hundred millions of miles of atoms until the last act on the Earth or some neighbouring planets completes the effects of the act commenced at the star—can well be dispensed with.

Unless the inert bodies of the planets be under constant impulse, it is allowable to insist they move of their own accord; then matter is not inert, motion is the natural state of matter and there are no first principles in modern philosophy, nothing of which can in reason be granted. Even by the Newtonian theory the Sun destroys rectilinear motion in making it orbicular, so that were there no constantly impelling means there could not be even orbicular motion nor other than finite centripetal motion.

It answers no purpose objecting that we know nothing of the medium of space, and questioning is it nitrogen, hydrogen or oxygen; we know nothing whatever of any medium, even the atmosphere, nor of any body in the System. Without a medium in space endless motion and in every direction could not exist; with one we have a universal cause analogous to every effect; and as there is no effect but what consists in motion, so wherever effects are produced the medium of space is present.

OPTICS.

TERMS AND EXPRESSIONS.

Sense-exciting cause or visual medium, the medium of space.

Axis of Vision, the medium of space lying in a straight line before the eye, in the direction of the axis of the eye and terminated by the body to which the eye is directed, as XC Fig. 1, XD Fig. 3, YB Fig. 5.

Visual continuity, the medium of space visually continuous angularly with the axis line, as CS Fig. 1, CS Fig. 3, BA AS Fig. 5.

Place of first continuity, where the axis line terminates, at C Fig. 1 and 3, B Fig. 5.

Minus pressure means, that which lessens the general or natural pressure on the retina by lessening it on the lines of vision. S lessens optic pressure on SX Fig. 1, on SC CX Fig, 3, and on SA AB BY Fig. 5.

Visual effect or result, the sensible mental effect, the sensation of light or colour.

Effect on the retina, change of pressure on the sense generally, which includes the optic nerve and brain, the altered pressure being on the nervous fluid or medium of space within the retina and optic nerve therefore on the brain.

PRINCIPLES OF VISION.

The medium of space, which pervades the atmosphere and is continuous through the optic nerve to the brain, is the sense-acting cause or visual medium. It is quiescent as respects vision. Its natural or greatest pressure on the brain is not productive of any visual effect or sensation therefore leaves the the Mind in visual darkness. The minimum of pressure on the brain is productive of the sensation of luminousness, or white light: and degrees of pressure between the maximum and minimum are productive of sensations of colour. The visual sensation seems always to belong to the body to which the eyes are directed.

The Sun, Flame and Daily Electric matter are minus-pressure means which lessen the visual pressure on the brain.

The visual sense-acting cause lies, to the eye, in a straight line direction corresponding with the axis of the eye: it is continuous angularly once or oftener from the body to which the eye is presented and is terminated by the minus-pressure means.

The visual continuity is different through connected media of unlike kinds.

An opaque body before the eyes impairs the visual continuity, by which the pressure on the brain is less reduced than were the eyes directed at once to the minus-pressure means.

FIG. 1.—Let AB represent a plain mirror or surface of water. X the Spectator, S a Candle-flame, the Sun or Moon.

The eye X being directed to S and the minus-pressure means S terminating the axis-line XS, the altered or reduced pressure on the retina promoted by S is productive in the mind of the sensation of luminousness. The part of the retina or brain thuswise brought under reduced pressure being, it may be said, of similar shape to that of S the terminating minus-pressure means, the mental effect or sensation is productive of the idea of form; and in consequence of S being apparently the place of the sensation it is imagined S is luminous and seen by the eyes.

When X is directed to C the perception is nearly as it was when directed at once to S, hence it is obvious S terminates the line of vision in both cases: so when XC is the axis CS is the continuous line of vision and C the point of first continuity.

That this continuity and direction of visual continuity obtains, is proveable by interposing some opaque body in any of the visual directions CS, XC or XS, or at C, which makes the perception become extinct. From which it is clear the visual sense-excitement is caused by the medium lying in the directions SC CX similarly as by that lying in the direction SX. That is, the reduced pressure on the retina, whence the sensation of luminousness, is caused by by S in the direction SC CX. The apparent place of the mental affect is in the axis-line XC produced the equal of CS, which makes it be thought an image of S is somehow in the direction CD. The sensation being apparently at or beneath the point of continuity C, and from the visual continuity taking place at equal angles with the plane AB, it is obvious that as the Spectator changes his situation the place of continuity also changes and is different with every different Spectator. Hence each thinks he sees an image on the water or mirror, but at a place which to no other Spectator there is an image. Hence also the image seems to change place on or in the water as the person moves along the river side.

While it is maintained the retina suffers reduced pressure by SC CX, it is to be understood that S is a minus-pressure means to the surrounding medium in all directions, but from the construction of the eye the retina is affected only by so much of the medium as lies in the directions SC CX. Were S suddenly removed, the sensible effect, luminousness, would cease to be excited there being no minus-pressure means present to affect the optic pressure; but as suddenly as S is replaced the perception becomes again excited. Rays of light from S to C thence to X and the brain could not possibly effect any thing similar.

FIG. 2.—Let AB represent the surface of a river, AE a ship's mast, P the pupil, TV the retina of the spectator's eye, AH the shadow or likeness of the mast.

When the eye P is directed to the place K on the water the perception in the mind is nearly the same as if the eye were directed upwards to E; the altered pressure on the retina and brain, in consequence of E being interposed in the visual direction, is by the continuous lines EK KT, and the mental effect or sensation seems to be in the axis line TK produced from K the equal of KE. Hence an image of the top of the mast is apparently at H. When the eye is directed to I, then FI IV is the visual continuity and the likeness of F is thought to be seen in the axis line VI extended to G.

That what is thus visually known as an image is nothing outwardly situated is a certainty, for were AB a mirror it is evident there could not be the likeness of a ship's mast extending sixty feet beneath the surface of the mirror.

The visual continuity from P does not end at the interposed body, but is maintained at equal angles from its surface in the directions EC FD continued to the minus-pressure means, the electric matter in the atmosphere during day time. For were an opaque body interposed in either of the directions EC FD the perception in the mind would be altered and the apparent image have shadow at H or G.

FIG. 3.—AB the top of a table on which rests the opaque body E, S a lighted candle, D the shadow of the body E, X the spectator.

When the eye X is directed to any part of the table outside the shadow, as C, the minus-pressure means S terminates the visual continuity, as XC CS and by SC CX the retina experiences change of pressure, from which arises the sensation of colour the apparent place of which is C and the sensation is thought to be the colour of the table. The sensation is not of luminousness, because the visual continuity at C is imperfect compared with that which takes place with transparent bodies which permit visual continuity somewhat beneath the surface. If now the eye be directed to D within the shadow, the visual continuity from X to S being intercepted at E as XD DE, there is no alteration of pressure effected on the retina of X, the perception therefore is of darkness of which D is the apparent place, from which it is conceived the whole of D is covered with shadow.

The visual continuity from without being through the pin-hole pupil of the eye and the perception conceived external visible light, has originated the idea that light is material and proceeds in straight lines from the sun and polished or shining bodies and in consequence that the shadow D is outlined rectinearly. But the straight line direction is that of the part of the quiescent medium by which at all times the retina can only be impressed. And as to the angles of visual continuity at C being equal in consequence of the perfect elasticity of light, it is overlooked that this assumed light should consist of atoms, which being hard and unalterable must necessarily be perfectly unelastic.

FIG. 4.—With two candles ST behind the body D there seem two equal shadows on the table and as if one overlapped in part the other making the portion E doubly dark.

When XC is the axis line, the visual continuity is XC CT, XC CS terminated by both minus-pressure flames, so that by each at the same time the retina has the pressure on it lessened, which makes C apparently doubly light to C, Fig. 3.

When XA is the axis line S terminates the continuity AS, but there is no continuity from A to T it being intercepted, as AO, by the body D (to avoid confusion in the figure the direction of continuity has been drawn AO, the true direction is AB). Then as X is affected by S, but not by T, the space A on the table is less light than C and apparently covered with a degree of shadow. The space E seems to be covered with deep shadow because when the eye is directed to it the visual continuity to both flames is intercepted by D, as XE EF, XE EB and in consequence the retina of X remains under the natural or unaltered pressure productive of darkness of which E is the apparent place. The remaining shadow is accounted for as that at A: there is no continuity from it to S and only to T.

FIG. 5.—BACD the walls of a room supposed to be coloured, S a lighted candle, XY a spectator as he changes his situation.

The room is imagined to be full of light, because in every direction of the spectator's eye visual perception, the sensation of colour which seem to be on one or other of the walls, is excited by the minus-pressure means S in consequence of the visual continuity in every instance being terminated by S,

When X is directed to C the continuity lies in the directions XC CS: S lessens the pressure on SC CX therefore on the retina of X; the perception in the mind is of colour, the apparent place of which is C the point of first continuity.

The spectator being at Y and YB the axis of vision line, he imagines B coloured similarly to C but less bright, which arises from the angular continuity to S being repeated as YB BA AS, which renders the continuity more and more imperfect and the optic pressure on S less reduced as angles of continuity are more numerous.

Were a mirror at C or the wall wetted, the perception with X would be that of luminousness or flame, owing to angular continuity being maintained perfect at the surface or somewhat beneath the surface of transparent bodies. Were a highly polished plate of metal at C the perception would also be that of luminousness, because in the polishing of the plate electric matter, which obstructs visual continuity, has been rubbed away.

There is no visual continuity through the upper part of pure candle-flame from being wholly electric matter which excludes the visual medium; the part beneath includes gas which includes the medium and this part we say we can see through, the upper part is opaque and what Davy calls solid flame. Then as electric matter intercepts the visual continuity and transparent surfaces promote it, the electric matter on the surface at C renders the continuity less perfect than a mirror at C. But the continuity from S to Y is less perfect still on account of it being repeated, by which the reduced pressure, caused by the interposition of S on BA, is less than on AS and is still less on BY, therefore the retina of Y is under less than that of X of reduced pressure, and that of Y is under pressure nearer the general pressure productive of the perception of darkness than the retina of X: hence the perception seemingly at B is less bright than the perception when the eye is directed to C. From which it may be considered a general law, that, according to the electric atmosphere of a body the visual continuity is more or less impaired and the optic pressure more or less reduced by which the mental effect is of this or that colour which to us seems the colour of the body. The sensation of colour is excited as by a prism; hence all colour may, in the language of the science, be considered a prismatically promoted sensible effect.

FIG. 6.—AB a window-shutter in a dark room, CD a small opening in the shutter, MN a section of a hair, FQ a paper screen, X the Spectator.

The nearer the hair is to the screen the more its shadow is lessened: when at MN the shadow is IK, when at RS it extends from T to V on the screen. Newton makes the same body produce always the same size shadow were it not for the body,—" by fits of easy reflection,"—throwing light from its surface into the shadow, as from M into IT and from N into KV, and by these fits he says, "the hair throws light into its shadow even before the incidental rays have touched the hair." This he imagined from certain circumstances taking place while a roll of paper in his hand was presented before the opening CD, and because he imagined the paper an object of eye-sight. These easy fits and reflections of the hair amount to, a musical cord having easy vibratory fits, that is, vibrating of its own " endeavour."

When the hair is wholly away the visual continuity from the entire of the screen between HL is maintained through CD to and beyond OP, as XH, HP, XL, LO, by which, to the Spectator at X, the whole of HL seems to be covered with light, that is, his perception at the time is apparently so much light on HL. But the part LQ is to him covered with shadow, from there being no visual continuity thence through the opening CD, XQ QE being terminated at E by the window-shutter.

The hair, when situated at MN, obstructs the visual continuity from only KI to and through CD, by terminating the lines of visual pressure XI, IM, XK, KN; so from there being no reduction of pressure on the retina of X, when X is directed to IK, the perception is that of darkness of which IK is the apparent place; and from MN being the preventing means the shadow apparently at IK is of the shape of MN. But when the hair is placed at RS it intercepts the visual continuity from so much of the screen as lies between TV, as XT, TR, XV, VS, in consequence there is no reduction of pressure on X, which causes TV to be considered covered with shadow formed on it by the hair obstructing rays of light. From which it is manifest the size or length of a shadow depends on the more or less of the visual continuity from the apparent place of the shadow to the minus-pressure means, which " makes the shadow lengthen as the sun declines."

FIG. 7.—Let ABD represent an empty vessel, C a shilling resting on the bottom, X the spectator.

Because when the spectator turns his eye in the direction of C, the axis-line XD is terminated by the opaque side AD of the vessel and there being no alteration of the optic pressure effected on the retina of X by C at the time, the shilling is said to be unseen. But when water is poured in as high as the dotted ines, the Observer imagines he sees the shilling, or an image of the shilling. Not having moved his poition and the shilling remaining unmoved, it is confessed an impossibility the shilling could be seen; and t being impossible a lettered image could be intantly formed, held suspended and remain immoveable in the water, it is asked what is that which is een. The answer is, nothing is seen in the water nor outside the mind. The object perceived is the ensation or sensible effect promoted by means of the hilling; which effect, to the spectator, seems to be ituated somewhere in the axis line XE produced towards F. Between EF is the apparent place of the perception in the mind. The eye X now being directed to the point E, on the water, the visual continuity, by means of the water, is maintained angularly to C in the directions XE, EC, and the altered pressure occasioned by C on the visual medium lying in this direction CE EX lessens the optic pressure on the retina of X, therefore on the brain, whence arises the sensation recognised as seeing an image of the shilling before the face and seen somewhere between EF.

The case is explanatory of what has been so generally considered refraction of rays of light; although no one can say or possibly conceive how an image is to be formed either in the water or on the retina by any such means. Similarly explained is that of the Sun said to be seen above, when he is below the horizon, by the refraction of light. To see the Sun itself it should be lifted above the intermediate convexity of the Earth: to see his image the image should be formed at the top of the refracted, or rather emitted, rays, afterwards refracted down to this world through the atmosphere, and then refracted by the lenses of the eyes. But believers in the impossible require no explanation, it being sufficient to them they see the out-of-sight Sun by refraction. Which amounts in the first instance to seeing round a hay stack; in the second to the refracted rays bringing with them an image of the Sun to place on the retina.

FIG. 8.—BA the edge of a plate of a glass, the Spectator being situated at X.

The eye X being directed to K there is no visual continuity with XK to F, KI is the direction of continuity. With KI there is no continuity to H, the continuity is KI, IE. A shilling placed at F or H would be unknown by the eye at X while directed to K, but placed at E it would be known and thought to be raised up to F, because of being apparently in the direction XKF of the eye. Were one placed at D, the the eye being at C, it would be mentally known and the perception apparently at D, by reason of the visual continuity lying in one straight line from the eye to the external body.

Oblique visual continuity as XK, KI, IE, is the whole which has been mistaken for refraction of rays of light by different media; which has excited so many delicate troublesome experiments and mathematical demonstrations, unfortunately before ascertaining there is no such substance as physical light in the whole of Nature to refract.

FIG. 9.—The penknife A, held vertically on a sheet of paper, when gently turned round on the point of its blade before the minus-pressure means S,

causes apparently two streaks of bright white light, somewhat curved, on the paper as those at ED.

Were the knife away and the eye directed to any part of the paper, as D, from the visual continuity XD, DS being terminated by the minus-pressure means S, and from the more or less perfect the continuity at the point D being in all cases dependent on the nature of the body where it takes place, the change of pressure on the retina of X is productive, ultimately, of the sensation of white and the paper in consequence is considered white all over. The knife now being placed on the paper the visual continuity is as before XD DS, also, by means of the blade and at the same time, XD DC CS; so that the optic pressure is doubly lessened, once by SD DX and again by SC CD DX, and from the same part of the retina of X being doubly affected at the same time, causes the sensation apparently at D to be so much whiter than in the absence of the knife-blade. When the knife is turned round on its point gently, the twofold visual continuity ceases to be maintained and the streaks disappear one by one; but as the revolution is being completed they return separately and for a while appear together on the paper. That there are two streaks at one time is owing to the shape of the blade which permits visual continuity from the different parts DE of the paper to S by the two sides of the blade and from the retina being affected on two different parts at the same time.

FIG. 10.—A vessel of water HGH as in the preceding case, Fig. 7, but with the round ruler AB laid across.

The visual continuity in the direction of the eye X being from X to E, thence through the water to C, thence upwards to A, is by A intercepted from T; so, from there being no minus-pressure effect by these lines AC CE EX on the retina, there is no sensation of light, and the contrary sensation, or that of darkness, seems to be at C. From XF FD DB being also discontinuous to T, D after the manner of C appears to be dark: and as all visual continuity from CD to T is intercepted by AB, the whole of CD is apparently covered with shadow. Were the other parts of the vessel filled with incidental rays emitted from the candle-flame T, they should be reflected from the inside surface of the side G, cover and obliterate the shadow CD.

FIG. 11.—Let BAC represent a large spherical concave mirror, in the centre of which is the flame S, the spectator being at X.

In whatever direction X is turned light is the perception, because every axis line has radius for the continuous line, and radius in every instance is terminated by S the common minus-pressure means; XC is the axis line, CS the continuous; so with XE ES, XD DS, XA AS; and similarly, were the eye turned to B. Hence it would be said the sphere is full of light emitted from the flame. But were one half of the inside surface of the mirror suddenly covered with an opaque substance or curtain, the light would be lessened to the inside spectator although the flame remain the same; which shows there is no emitted light in question. This however is got over by saying, the opaque substance absorbs therefore does not reflect the light; but which could not prevent emission; and as by absorbing, the curtain does not in time become sated and luminous nor give out light on the outside, the objection is groundless. Were the sphere transparent and without the partial inside covering, it is discoverable that the inside is not full of light and appears to be luminons only according to the situation of an outward spectator and direction of his eyes. So that there is nothing in the case in support of the theory of emitted rays of light from flame. The place of first continuity being apparently that of the perception, causes it to be imagined glass, china and metallic vessels on our tables shine and reflect rays of light from their surfaces to our eyes. Which is refuted by presenting a dark body to receive any reflected shining light and by the spectator's changing his situation, when to himself there is neither shine nor reflection where in his former situation he imagined these circumstances took place.

FIG. 12.—AB a plane mirror vertically posited, C the forehead, D the chin of the spectator, P the pupil of his eye, RN the retina.

The person before the mirror imagines he sees an image of his face situated as far behind the mirror as he is distant from the surface in the opposite direction. What he knows by directing his eyes to the mirror is but the sensible effect which is apparently in the direction of his eyes: there is no image on much less behind the mirror.

The eye at P being directed to the point G on the mirror and the visual continuity with PG being GC terminated by the forehead, the retina of P suffers reduced pressure by CG GN and the sensation of colour, recognised as the likeness of the forehead, seems to be in the axis of vision line NG extended beyond G the equal of GC or at F. The chin D affects the pressure of the visual medium lying in the directions DK KR, and the sensation resulting, in consequence of the optic pressure being lessened on the retina at R, is apparently in the axis line RK produced H.

FIG. 13.—MB NE two vertical mirrors with their planes parallel to each other; P the pupil R the retina of the spectator's eye, S a candle-flame situated between the mirrors.

To the spectator there seems as many images of the flame S on the mirror MB as there are points of first continuity MKHFDB; the whole appear in the same line before the face in perspective, and each is prismatically coloured according to its remoteness.

The spectator's eye P being directed to the point B and the sensible effect similar to that excited when his eye is directed to S at once, S necessarily terminates the lines of vision, which are PB BS, the altered pressure on which by S affects the retina R on one point, which is productive of the sensation recognised as an image of S situated at B.

When P is directed to D, the axis line and continuity thence to S lie in the directions PD DE ES. At or beyond D, the place of first continuity, appears as if having on it a second image of S, from some other part of the retina being affected by the sense-acting cause lying in the directions SE ED DR.

The spectator's eye being directed to M, an image of S seems to be at M and the visual continuity is maintained in the angular directions PM MN NH HI ID DE ES. As the direction of the eye is changed the retina is affected on a different part and as many mental images are known at once, all apparently on the glass, as equal the number of different parts of the retina similarly affected at the same time.

That the visual continuity is as represented in the figure, may be ascertained by interposing in any of the assigned lines an opaque body, or placing a pencil on any point of first continuity: if on B the images BFK disappear; if on D those at DHM disappear. The pin V stuck at one side of the candle causes the images BFK to be accompanied with an image of the pin, in consequence of the visual continuity from KFB being terminated at the side V of the candle. So from all other continuous lines being terminated by the side of the candle opposite V, there is no image of the pin at MHD.

If either of the mirrors be moved sideways, up or down, still maintaining the parallelism of their planes, the line of images remains unbroken; no one image is altered in outline or distinctness. Were the images formed of reflected rays this could not take place, neither could the whole be reformed instantaneously on different parts of the mirror during its being moved. How a ray of light could be impelled or emitted by the candle is puzzling to imagine; how one arrived at B could be impelled from B thence to G thence to F thence to LKR is equally so; but most of all, how it can be so universally agreed upon, that, after these several unaccountable reflections, an image of S can be formed on the retina by rays thrown about after such a manner, shuttle-cocked, as it were, with the justest aim through the almost mathematical orifice constituting the pupil of the eye. Well for mankind it is there is no light, or that this light has no momentum, or its atoms from repeated impulsive reflections would be as pellets in succession from the steam battery of Mr. Perkins against which even Gulliver could not protect his otherwise invulnerable body. Against solar atoms if not of accelerated motion of undeclining force, and at no expense, neither the force of gunpowder nor the burning lenses of Archimedes could avail.

Nothing but a quiescent medium, existing generally without, and under pressure, continuous thence to the retina and included within the optic nerve so as to pervade all the ramifications of that nerve in the brain, becoming continuous in certain angular directions by interposed mirrors and subject to reduction of pressure by flame, whereby the brain suffers change of excitement productive of a sensation that seems to belong to the minus-pressure cause and seems to be situated before the face, can account for the phenomenon rationally and consistently with the functions of the visual sense.

So far from the images being formations by rays reflected from mirror to mirror, a similar series of images is effected by means of a single mirror and candle. Let the observer direct his eye very obliquely to a plane mirror and have the candle moved to and from the glass, then, in some certain position of the whole, the perception becomes excited which to him is a series of different size images of the flame far behind the mirror similar to what he knows when two mirrors are employed. How, it may be asked, is a single mirror to reflect rays from and to itself or can there be any real image, excepting the mental effect should be resolved into an image.

The flat eye-lash hair, when moist, contributes to the visual continuity and mental effect mirror-like. By some one of these a person may "see an image of his own eye" before his face, as by means of a mirror, a circumstance perhaps never before noticed.

Aged eyes particularly promote this optic perception, not deception. To such there frequently appears as if streams of light of gauze-like tissue issued downwards from the candle-flame. If to these the eyes, a little closed, be directed and the head gently moved from right to left and back to the right, at the same time a little upwards and downwards for the purpose of bringing some one eye-lash hair to "act the mirror," the perception will be excited and an image of the Observer's eye seem to himself, to be involved in the gauze-like stream of light apparently before his face. The trial requires patience and frequent repetition. The gauze-like appearance of the perception may be owing to the greater porosity of aged eyes.

FIG. 14.—DHK a multiplying lens; P the pupil, MO the retina of the Spectator's eye, X a Billiard-ball.

The ball being interposed in the line of visual continuity NFE, affects the optic pressure on XN therefore on the brain, and the resulting sensation being apparently identical with X, the ball is said to be seen through the lens. At the same time the visual continuity to X is maintained from other parts of the retina as MO according to ML LD DX, or as OG, GH, HX and the mental effect makes it be thought there is a second ball seen in the direction ML at C, also a third in the direction OG at B. Three equal balls being known at once and but one present, shows that the whole known are equally sensations of colour that to the Spectator seem to be situated at BXC. If BC be considered coloured images, where are they, not at BC or they would be known to a second Spectator by means of his naked eye; if in the mind, then BXC are all equally but mental images and the uncoloured ball X is not seen. How is it conceivable that rays should proceed from X to D, thence to L, thence to M, and then of the whole some few fall on M so as to settle in an image of X the external body, or of any body no matter the irregularity of its shape. Whereas, taking the lines of vision as so much of the medium of space by which the retina becomes affected from the pressure on it being altered by means of the external interposed body and the mental effect being seemingly belonging to that body there is nothing abstruse in the case.

FIG. 15.—AB a double convex lens, H a sheet of paper, P the pupil, EFX the retina of the eye, S a

It is said rays of light are thrown from S on AB which in passing through the lens are by it converged so as to form a cone of light AIB the apex of which is at I; and that the rays constituting the cone diverge from I to CD where they form an image of S on the paper. By this statement of circumstances several principles are assumed, not one of which has any foundation in reason or fact. Light is nothing thrown from S rays of light being as rays of music: the lens is incapable of converging rays were there any: there is no image on the paper.

The double convex lens AB may have been formed out of a parallelopiped of glass, as T, through which rays of light are said to pass freely in parallel lines. Then as there is no converging of rays by the greater mass of converging substance, why should there be any when as T its solid angles have been removed and the remainder reduced in substance so as to facilitate transmission of rays. Why should rays that pass freely through the entire block T and thickest part of the lens AB not pass more freely through the thinnest, and why experience such difficulty as obliges them to diverge from the thinnest into the thickest part. What gives them the requisite second impulse for their novel direction of motion; and how can radiated or reflected rays make a likeness of the body to which they have ceased to belong. These circumstances not being accounted for by Philosophers have been overlooked in consequence of the image system being allowed to speak for itself and because the nature of evidence by the senses has been so little enquired into and when understood misapplied in philosophising. Nor has it been noticed why the image CD should be surrounded with shadow of the transparent body AB as represented by Fig. 22.

On the principles of visual pressure by a quiescent medium, the phenomenon may be illustrated consistently and reasonably after the following manner.

Were the sheet of paper H at I and the spectator's eye directed to the focal point I, of the whole sheet of paper there is no point on it but I whence there is visual continuity to S through AB. The apparent cone of light AIB is but so much of the medium between the paper and lens which maintains visual continuity through the lens to S. The lens intercepts the continuity from all parts of the paper immediately round the focal point.

While it is maintained by Newtonians the cone is formed of a stream of converged light flowing rapidly from S through the lens to the screen, it may be questioned of them, how is the cone itself seen, what rays proceed from it to the eye of a Spectator; to fly off of their own accord is impossible; and as without rays entering the eye and an image being formed by them on the retina seeing, the cone without such rays is seeing it at once by the eyes and this also is contrary to the fact and theory. The case affords indisputable proof that vision is not promoted by rays entering the eyes and as for the cone being a subject of eye, sight nothing can be less true.

Were S the Sun and AB a hole in a window-shutter, AIB would be considered a sunbeam of perhaps one or two inches width. Were AIB a current of light flowing into the room for some hours, nothing could prevent it filling the room, whereas it makes shadows and removes none. Saying it causes shadows by flowing in a straight line is no reason, while its reflexions back from the wall on which it impinges, although in straight lines, should cause it to fall into and remove all shadow and fill the room with light. The cone AIB, also that which is imagined the sunbeam is that part only of the visual medium under reduced pressure, the first being terminated by S the latter by the Sun, each of which is a minus-pressure means to the axis of vision line. The eye at X being directed to the cone, the visual continuity may be considered as XK KS and the cone the apparent place of the perception. Or the cone itself and similarly with the appa-

nt sunbeam, from being under reduced pressure oc-
sioned by S or the Sun, may be a minus-pressure
eans to the axis line KX : and from the perception
ing seemingly at K it is imagined the cone, also the
mbeam, is luminous and each an object of eye-sight.
ere there no minus-pressure on that part of the
edium constituting the cone and sunbeam, there is
o way of accounting for the sensation which makes
be thought there is a luminous cone and sunbeam
efore the face but by maintaining that the visual
ontinuity takes place in the air at right angles to the
xis line or as XK KS, which, however, is not contrary
the general law that the retina is affected by the
edium lying in the axis of vision line or before the
ye terminated by some interposing opaque body, a
irror or water. A cloud promotes the continuity
ut of the axis line direction as in cases of parhelia,
lso water, see Fig. 7. The like is promoted by smoke,
s in the exhibition of the phantasmagoria, where by
neans of the interposed ascending smoke the visual
ontinuity is maintained thence to a room beneath
nd being terminated by portraits and busts of de-
eased persons in succession, the perceptions in the
ninds of the spectators are as ghosts of the deceased
efore their face in the darkened room where the
ompany are assembled.

The paper H being removed beyond the focal point I, the visual continuity is now EDAGS to the base of S, FCBGS to the apex. The retina at E being affected by the base at F by the apex at E, the mental effect seems to be an inverted image of S at DC.

FIG. 16.—IK a double concave, OR a double convex lens, AB the body to which the eye X is directed.

The lens IK may have been formed out of a piece of glass, similar to V, Fig. 15, through which light is said to flow in parallel rays; grinding the glass to make it thinner in the middle, or doubly concave, should have no effect on the parallelism of rays, nor other than the promoting the flow towards and through the least resisting part of the glass; by which convergency should take place, whereas the double concave lens is said to diverge the rays.

The lenses OR IK when in the telescopic tube assist in promoting the visual sensible effect somewhat after the following manner. The whole of the visual medium between XOC XRH,—in the absense of the lens IK,—is continuous from X through the lens OR to HC, which is but a small portion of the body AB, and the perception in the mind results from the alteration of pressure occasioned by the part HC on the medium in contact with HC, which, from being continuous thence to the retina of X affects the optic nerve so as to excite the brain and ultimately originate the sensation of colour imagined the colour or likeness of HC. But when the lens IK is interposed between the body AB and the lens OR, the visual continuity from X is maintained to the whole of AB as XOIA XRKB. Accordingly as lenses differ in shape it is reasonable to conceive the direction of continuity through them is also different, which in this instance may be as the lines XOI IA, and IL or XR RK KM. After this manner, with the two lenses the visual continuity from X is maintained, by which the whole of AB is concerned in altering the visual pressure productive of the mental effect, which effect to us is seeing the entire of the external object by means of the lenses of a telescope.

FIG. 17.—The prism A being before the eye of which *b r* is the retina P the pupil; the card BR to which the eye is directed is one half painted to appear blue the other half red and seems to be before the face divided as TV, which Newton says is caused by the prism refracting the blue making rays, reflected from B, differently from the red making rays reflected by R through the prism to the retina *b r*. The phenomenon admits of the following more conceivable tration. The card, to excite the different sensa has its surface covered with different kinds of each of which affects the continuity, therefo visual pressure, differently; one lessens it on the more than the other, the blue least and hen different perceptions. The half R of the car motes reduced pressure on *b*, the half B on visual continuity being somewhat as the lines figure. The sensible effect from the degree o sure on *b* seems to terminate the line of cont EV, the sensation from that on *r* is apparently

FIG. 18.—The prism AD being applied to t server's eye of which P is the pupil and Y retina, the visual continuity through it from Y body G is YPK KG; from R to G it lies through rent part of the prism as RPH HG, and from B EG, by which the retina is affected—that is, the pressure is altered on it at the three differen RYB. The altered visual pressure effected b the medium continuous from G to the retina, is liarly altered by the manner the continuity is tained through the prism and differently by one APY HPK, hence at RYB as the pressure i

rently reduced the perception thuswise promoted by the remote causes G and the prism is of various colours all of which seem to belong to G. Moreover, it is probable the many coloured mental effect depends in some measure on the visual continuity through the lens being rather in *curved* than straight lines, as PC curved rather than PC straight. In fact it is but reasonable to conceive the continuity from P to the side AD lies in several curves commencing at the point P immediately before the Spectator's eye, diverging thence, and all terminating at different parts of the surface AD, from each of which the visual continuity is rectilinear to G. For when XH or XK is the visual direction, the perception by means of G is not of prismatic colours particularly so named, but the same as by the naked eye when directed to G. Newton allows angles of no refraction to the prism, although the whole are equal among themselves and by all, if by any, should light be refracted were the sense-acting cause transmitted rays: but what reason or cause is there that rays reflected from G should enter the prism at H and proceed thence upwards to R and others enter at C proceed downwards to B. On the other hand there is nothing hypothetical in G and the prism altering the visual pressure and the prism promoting the visual continuity in almost all manner of directions. As the brain is differently impressed by such means the perception should be of the dissimilar colours termed prismatic and simple.

FIG. 19.—AB a small opening in the window-shutter of a darkened room, S the Sun, CP a prism, RB a double convex lens covered with paper on the side facing the prism, D a paper screen, GF another screen, ZTX the spectator in different situations.

The eye Z being directed to the paper on the lens RB from which the visual continuity to S lies through different parts of PC, the retina of Z is affected on different parts as 1, 2, 3, and the resulting perception seems to be a prismatic spectrum RYB on the paper.

The paper covering being removed from RB there now seems to be on D a spectrum of circular bright white light; because the continuity from T to D thence to S, is, TD thence to RB including the entire cone RDB, thence to the prism including the cone RCB, and from C divergently through different parts of the prism to S. At Z the retina is affected on three different parts and at each by a different colour exciting reduced pressure; at T the pressure is on one part only of the retina and the reduction being equal to the whole reduction on the retina of Z, the perception to the spectator at T is that of luminousness apparently situated at D, which is considered by some a spectrum of white light formed by rays of converged coloured light, by others an image of the Sun.

If now a small hole be made in the paper at D, a coloured spectrum as before at RYB is to X apparently on the screen GF: because with the axis line XG the continuity is not from G to S through the prism generally, but through one particular part only, as XG DBCPS and similar with XEDFCS XFDRCS by which the visual pressure on the retina of X is reduced unequally on three different parts, as on the retina of Z, whence are excited in the mind the different spectric colours apparently situated at GEF.

The experiment is one of Newton's most beautiful; his illustration the most misleading. Judging by the assumed eye-sight evidence and materiality of light, the whole is considered true; but by the offices of the senses and the mental nature of what is perceived the entire is fallacious. At GEF Newton says are the blue, yellow and red making rays of the decomposed white light at D; for if a prism be interposed in the ray GD the colour or ray GD remains unaltered, therefore DG is a simple ray and the white light D a compound of red, yellow and blue making rays. Whereas nothing is proved by a prism placed between DG DE or DF, but that the visual continuity lies through it in like manner as through the prism C, as already described.

FIG. 20.—S the Sun, KM a prism, RB a plano-convex lens, N a screen of paper.

The plane side RYB of the lens being covered with paper, there is on it, apparently, the prismatic colours red, yellow and blue, the yellow being in the middle. Because the visual continuity from XR to S lies through one particular part of the prism as XR RG GK KS, the visual pressure altered by the prism on the retina of X at *r* is productive of the sensation of red, of which R is the apparent place. After the like manner the sensations of yellow and blue are excited by reason of the retina being affected differently at *by* for the promoting of each sensation, and each sensation seems to be on the paper covering the lens, the blue at bottom, red at top.

If now the paper be removed from the middle, or that part on which there is apparently the prismatic yellow, there is manifestly nothing of yellow rays transmitted to the screen N: the spectrum apparently at N is circular white light. The first remark the case suggests is this, the spectrum at N is circular, but not circular at either RY or B; the reason will appear. The author of the experiment, Doctor Reade, of Cork, asks, why is not the spectrum at N yellow; but being white without the red R and without the blue B, it is evident, he says, white light is not a compound of red, yellow and blue rays, than which there can be no greater proof, nor conclusion more indisputable, than, that, white light is not formed of colour-making rays.

The visual continuity from S to T and V when TN is the axis of vision line, is SKGNT SLHNT SMINT; so that the visual pressure by NV is the reduced pressure effected by the different parts GHI of the prism at once, and on one part only of the retina V; the consequence is, the perception by T is white light that seems to be at N. The reduced pressure on the retina V is equal to the amount of the whole on *r*, but *r* has the pressure reduced on three distinct parts *b y r*, whereas on V the whole is lessened on but one part, hence X perceives colours, T white light.

FIG. 21.—The *Camera obscura*. KLL an external object, MN a double convex lens, BE the mirror, AB the plate of ground glass on which at FGH there is imagined an image likeness of KLL.

When X is directed to H, the visual continuity from

H is HC CN NK, the reduced pressure on which is productive in the mind of the perception the like of K and as H, the place of first continuity, is the apparent place of the perception, at H there seems to be an image of the upper part of the pyramid K. When XF is the axis line the visual continuity thence is, to FD DM ML, the pressure on which so affects the retina of X as to excite the sensible effect, which, from being seemingly at FG, is imagined to be the likeness of the lower part of the pyramid formed by rays of light reflected from it through MN to D thence to FG on the rough glass, thence to the retina of X.

Now, were rays reflected after this manner to the retina of X, it may be questioned the cause of any stopping on the permeable glass in the form of the body KLL; and if without stopping they proceed to X, they could not form themselves into an image on the glass. Neither could they form on the retina an image, nor carry themselves in the form of an image of KL through the air in various directions so as afterwards to impress the retina with a miniature likeness of the external object.

FIG. 22.—Let A represent a paper screen, HF a candle flame, between which is the double convex

lens VZ, having round its edge a polished silver rim, P the pupil, M the retina of the spectator's eye.

On the screen at K there seems to be an inverted image of the flame HF surrounded with a circular shadow, at some distance from which is apparently a circle of strong white light LN.

In the absence of the lens and the eye P being directed to C, or any other part of the paper, the perception is white and it seems to the spectator as white belonging to the paper. In this instance the visual continuity from P to the flame being PC CH and the minus-pressure flame H terminating the visual continuity, the altered pressure H effects on HC CM, is productive in the mind of the sensation of white, which, from being apparently at C, or where the eye is directed on the paper, makes the screen seem to be considered white all over.

The lens VZ being now placed between the screen and flame, as in the figure, the visual continuity from the part of the paper where the image KI is apparently to HF, is limited to the different portions of the intermediate medium included between the lines KZ ZH IV VF. So when P is directed to KI, the visual pressure promoted by HF affects the retina at M so as to be productive ultimately of the mental effect recognised as an image of the flame HF, which effect is apparently at KI. And because H affects the retina on one part while F affects it on a different adjoining part beneath, which from being contrary to what takes place when the eye is directed to HF immediately, the perception, supposed on the screen, is inverted. The apex H alters the visual pressure on the part M, by which it seems to terminate MI, and the base F alters the optic pressure on the part beneath M, whereas with the naked eye the parts of the retina affected by HF maintain contrary relative positions.

There being no visual continuity through VZ to HF from the paper where there seems to be a circular shadow, so when P is directed to this apparently shadowed part, the retina of P undergoes no change from the natural pressure, consequently the perception is of darkness, which makes it be thought that part of the paper which is immediately round the apparent image is covered with shadow.

When P is directed to any part of the bright ring as L, the visual continuity thence to the flame is PL LH; but at the same time the continuity is also maintained in the direction PL LV to the outside of the polished rim of the lens, and from V to the flame: so that by these twofold means the retina of P is affected doubly; by HLLP and HVLLP; in consequence of which the pressure on the retina of P is reduced twofold, from which the sensible effect is that of bright white light, of which L, and all parts where there seems the broad ring of white light, is the apparent place.

Similar to the circle of light LN is the apparent halo round the Moon. Let the smallest circle DKI represent the Moon. Then when the direction of vision is to any part of the halo, as PL, the continuity being LD terminated by the Moon, at the place of first continuity L seems to be situated the sensible effect in which alone consists the luminous halo. The state of the air it is which promotes the angular continuity and may indicate approaching change of weather, but the light circle is altogether mental. Newton accounts for the phenomena by saying, the air about the Moon at such time contains hail stones a little flattened, through which the lunar reflected rays in passing become refracted at an angle of something less than sixty degrees. But as hail stones cannot be stationary in the air, nor the sense know any thing of the remote refraction, the theory is not founded in any thing like reason or fact. The like of the halo is made known by steam on a window, a candle being within the observer on the outside. As the spectator moves about, the halo seem to change from pane to pane. When he is inside the room there is no halo on any part of the window, which proves the natural phenomenon, so far as that the visual knowledge of one, in every instance, is but a mental effect, and that the halo whether promoted by the air or steam is the consequence of the visual continuity lying angularly with the axis of vision line of the spectator.

The foregoing experiment affords additional proof of the inconsistency of the Newtonian theory, which maintains that incidental rays are partly absorbed and partly reflected from bodies: that, by the reflected portion entering our eyes we see the reflecting body; and that bodies which are black absorb the whole of the incidental rays. For instead of the white paper screen A, if we substitute black cloth or the sooty back of a chimney, a coloured image of the candle flame by means of the lens VZ is apparently as distinctly formed on it as on white paper: whereas the Newtonian theory inculcates that the rays should be all absorbed, none reflected and of consequence no image formed on either a black screen or the retina. Again, Newton says a body is seen of the colour of the prismatic rays in which it may be placed: in the red of the spectrum the body is seen red, in the yellow yellow and in the blue blue. Now why should a red rose be seen yellow in the yellow rays, In the open air the red rose is said to reflect red rays and absorb the yellow and blue; then in the yellow only it should still absorb the yellow and not reflect any of the yellow rays; but in being visibly yellow by reflecting the yellow, the theory stands contradicted: and in being seen yellow while the rose is not yellow, is proof the sensation of colour alone is perceived, leaving the flower itself unperceived.

FIG. 23.—*Coloured shadows.* A a sheet of paper, ED a flat ruler, S a candle flame, Q a spectator.

On the paper there seems to be at CB a shadow the shape and size of the ruler ED; which is occasioned by ED preventing all visual continuity from CB to S. For when Q is directed to B, QB BD is terminated by ED which also terminates the visual lines QC CE. Therefore as S effects no reduction of pressure on the retina of Q by EC CQ DB BQ the natural optic pressure on Q remains unaltered and the perception is that of darkness of which CB is apparently the place.

The figure to the left is the sheet of paper under different circumstances. Before it is the ruler suspended by threads for the convenience of moving it to and from the screen and fixing it in any required position. OP is a flat-sided bottle containing an aqueous fluid considered blue, the bottle is posited between the ruler and flame R.

Now, if the ruler be removed the bottle and its contents cause the paper to lose its whiteness, it seems of various hues, one portion being of a bluish tint, another inclining to yellow, another to red. If a pen or pencil be drawn along either side of the bottle, the shadow it makes on the paper shows that the different tints on the paper are owing to the direction of the visual continuity from the paper through the bottle to the minus-pressure means R being *prismatically*, through the bottle.

Upon replacing the ruler at GH and moving it near the paper, a shadow is formed similar to ZYW, dark in the middle Y, blue at Z, yellow at W.

When the ruler is drawn farther from the paper the dark shadow disappears, and two coloured shadows, each the shape of the ruler, are formed some distance from each other, the upper one KL bright blue, the other MN bright yellow, each distinctly outlined.

By trial it will be found, upon passing a pencil along the edges of the ruler, that the visual continuity from KL to R is through one part only of the bottle and somewhat in the following directions, commencing with the spectator V: VL LO OR, VK KO OR through what may be termed the blue-making part O of the bottle: while in the same direction of the eye V, all visual continuity from KL to the yellow-making part P is intercepted by GH as VL LT VK KF. So that the prismatic pressure, promoted by O, on the medium lying in the directions ROKV ROLV is productive in the mind of the spectator of the sensation of blue, and KL is apparently the place of the sensation. Then taking into consideration the varied hue of the paper in the absence of the ruler, KL it may be said, which was so much that had the mixed hue, is now blue from being deprived of the yellow and of all else that made it of that hue excepting the blue.

In like manner when V is directed to MN the visual continuity is maintained thence to R through P and obstructed by GH to R through O: so that MN may be said to be the original mixed hue less the blue, which leaves it yellow. When the sheet of paper or screen is elevated above its present position, a shadow of similar shape to KL is obtained above KL of bright red, in consequence of all visual continuity from the apparent place of the red to R through both O and P being intercepted by the ruler and lying only through the upper part of the bottle. The bottle is a prism in the case.

FIG. 24.—Let EF represent the inside of a chamber having the open window D in front. On the wall facing the window is the paper screen TV the Sun S being vertical to the screen, G an outhouse with a tiled roof, B a walking cane held before the screen, BM a section of the cane. The spectator F is within the chamber.

Upon the cane being held before and parallel to the screen, on the latter there are apparently thirteen shadows faintly coloured. In this case the visual continuity is as FN NB IS. There being thirteen rows of tiles on the roof I, and the same number of shadows on TV, shows that the continuity at each row, as at I, is concerned in promoting the spectrum. And as when a pencil is drawn along the cane, either on the upper side B or lower M, the tint of each shadow is altered, it is inferable the visual continuity at B for the production of each shadow is maintained at the same time at both sides, the upper and lower, of the cane after the manner of RQ. It is after this manner the coloured shadows of leaves and plants are formed, also of the window-sash apparently on the linen blinds during a certain elevation of the Sun. While the phenomena of coloured shadows are attributed to refraction, in the present instance there is proof to the contrary. The ray SI is said to be reflected from I to

B, thence to N, thence to F and through but one medium. Throughout the whole there are none but reflecting means, therefore there is no refraction, and the entire is but a species of prismatically promoted sensation of colour arising from optic pressure.

The foregoing optical figures may not be perfect, according to the diagrams of their several authors, the whole being described from memory. The last three are not copies; and as thirty years have elapsed since I first made the experiments, the description of which has been accidentally destroyed, I have devised them according to the best of my recollection for the purpose of illustrating the theory.

MATTER.

Matter is the substance of which all terrestrial bodies are formed.

The term Matter should, as much as possible, be confined to atomic substance in the uncombined or elementary state and as little as possible applied to body; for although all bodies are composed of Matter the terms *matter* and *body* admit each of a distinct idea. Much misapplied argument would be avoided by a strict adherence to this necessary distinction. Thus, Matter is said to be infinitely divisible of which various specious proofs are advanced; even mathematical diagrams and reasoning are made use of in support of the doctrine, yet Matter is not divisible, all Nature cannot divide a single atom, there is nothing divisible but body.

That Matter consists of atoms infinitely small, is made manifest in the great divisibility of bodies and much greater of their parts when converted to the gaseous state. The atoms of Air are inappreciably small, yet vastly smaller are those transmissible through solid pelucid bodies. No idea can be formed of the extreme diminutiveness of even the largest atom.

The whole of the atoms of Matter may be considered hard, opaque, impenetrable, unalterable, inert and homogeneous, and there are strong reasons for concluding they are of a common shape, which is the spherical.

That elementary atoms are hard, is deducible from the unyielding nature of the most solid bodies; and as solids and fluids are convertible into airs, which are convertible into solids and fluids, it is inferable that all atoms are alike hard. Were they otherwise they would be compressible and divisible, which would in time render them unfit for general service and alter Nature in all respects from what it has been hitherto: were they compressible nothing in Nature could restore even a single compressed atom to its former state; but as the gases of decomposed solids and fluids are the same after as before being combined, it is obvious their atoms have undergone no alteration, from which it may be concluded they are unalterably hard. Were they not opaque all bodies would be transparent, nor can a particular element to promote transparency be surmised: transparency depends on bodily porosity, which is manifest by a transparent body being formed of similar matter to that of one which is opaque. Atoms being hard and opaque and each consisting in unity of substance, it follows the whole are impenetrable. That the whole should be unalterable is indispensable to the consistency of Nature and its laws. The like bodies exist now as in the beginning; the laws of Nature are constant, the like effects constantly take place now as formerly; were matter any way alterable it would be known by the procedure becoming irregular throughout. No good purpose could obtain from atomic alteration: nor is the necessity for divisibility conceivable but to increase the number of molecules, which is in nowise requisite, atomic substance having been provided in sufficient quantity for the formation of a universe of worlds.

The schoolmen's infinite divisibility of matter is absurd although mathematically illustrated. Could an atom be divided infinitely each of its quarters should be equally so, which would allow at least four infinities in one finite atom. The error lies in mistaking body for matter; and then as a body has a limited number of atoms even the largest body cannot admit of infinite subdivision. Attenuating gold on wire is not dividing matter. Nor can the mathematical illustration, by dividing a line perpendicular to the two parallels by which it is bounded, be correct, the line being finite it cannot be divided infinitely. Then again, what proof is there in ever so many divisions of a mathematical line that an atom, not composed of parts, is fracturable into even two parts. Conceiving the halves of an atom is no proof of the breakability of an atom: neither do two opposite surfaces of an atom prove parts and divisibility into parts, but only different surfaces.

That all elementary atoms are inert is rationally evident, each being but a molecule of mere substance without life, organization or parts. In moral philosophy inertia means inferior ability and ability sluggishly exerted; in Physics it signifies no ability or power whatever. Making inertia a "passive power" amounts to no power; power implies acting, passive power not acting or that can act, but power is never passive. Inertia being an "inert force" is the same as force without force: "*vis inertiæ*" is the force of inactivity, the power of inability. All bodies are convertible into powers, but are such only while being made to act. To say a body "resists" by means of its inertia, is making nothing a physical force. Who can conceive force at rest. Inertia causing "an endeavour and perseverance in a body to continue in motion or at rest" is a contradiction in terms and disproved by a baloon ceasing to ascend in the air and a cork in water although each is constantly approaching a rarer medium, its motion is by constant impulse; its rest is but the result of a terminated effect. Inertia is no cause, it is nothing active or passive. The resistance of a ponderable body at rest is caused by that which makes it ponderable. Inertia being nothing is productive of nothing; it may be said to be the zero of cause.

Of the homogeneity of matter there can be no question, it follows from every atom being essentially inert: for as all means of action are denied essential difference can be of no utility. Essence being identical with substance, matter unalterable and incapable of acting, there can be neither essential action nor communication of essential quality between either atoms or bodies. Hence matter is to be reasoned on as mere atomic substance of unknown, inactive essence, unalterable in its nature and everlasting, and as if its atoms had been formed out of a single mass of homogeneous substance. Primevally matter existed in the elementary state, and out of the immense volume all bodies have derived their substance even the Earth itself. Therefore essential qualities and properties are as foreign to bodies as inertia, philosophically speaking, is essential to matter. Essence and Inertia, are equally but negative qualities in physical science. In both we have an unerring guide to prevent imputing to bodies what cannot belong to matter, namely, capability of acting either essentially or mechanically one on another, or otherwise than impulsively by means of the general pressure.

As to the shape of the atoms of matter, there are several cogent reasons for concluding it is spherical. First, had bodies no interstices their expansion would be a physical impossibility: unless there be interstices for some species of matter under physical force to enter, enlargement of volume cannot be produced; and were the atoms of bodies other than spherical, their sided planes would prevent both expansion and dissolution. Where nothing can enter to effect separation, existing pressure externally applied must retain all atoms inseparably connected. Nothing short of spherical atoms can at all times promote uniform expansion. Free ingress and egress of the expanding cause is indispensable towards uniform expansion and contraction; and no shape but the spherical permits this flow and ebb, yet leaves the atoms of a body in contact, and in the most contracted state of the body affords openings for the entrance of the medium of expansion. Could it be proved the oval form is best adapted for variety of purpose, still in theory there can be but little difference, the main object is to show that all atoms may possess similarity of shape, and that the sided or angular is in no respect the most eligible for universal purposes. It is well known that a fluid may have added to and dissolved in it several different substances without increasing its volume, for the reception of the atoms of which there must be atomic interstices; and as solids are convertible to fluids and airs the atomic shape is the same in all. Then again, as diaphanous bodies, solid and fluid, are uniformly porous the inference is that atoms are all of the same shape and spherical. The contrary is not proved by bodies which are opaque; their interstices being previously occupied by minor elementary matter prevents the visual continuity; still minor interstices exist or expansion of glass could not be effected. Even a solid crystal may be opaque in part, and to make it uniformly transparent requires only the removal by fire of the opaque matter occupying its interstices. In the great mobility of fluids there is corresponding evidence of the atoms of matter being spherical. Geologists infer the atomic shape is similar to that of the crystalized body, by maintaining that the shape of a crystal depends on that of its nucleus; yet some crystals have no nucleus, some have shape different from the nucleus, and the same solution is productive of crystals of different external forms. The shape of a crystal is produced by external pressure; and although some solutions crystalize always after the same manner, yet as symmetrical form by compression implies the body having been in the fluid or in a plastic state, could external pressure by means of art be applied during crystalization, it is obvious any crystal might be moulded differently from what it is naturally by the general pressure; so that external form is no indication whatever of the shape of the atoms of matter. A nucleus has its nucleus until we arrive at a molecule, and the form of the crystal from the same solution being variable nothing of the shape of atom is discoverable by that of either the nucleus or crystal. A humid cube might be converted to a sphere by preventing in the new formation all solid angles: here nucleus has nothing to do with causing external form: and as the smoothest surface is admitted, when viewed microscopically, to be full of indentures, so may the planes of the most perfectly formed cubical crystal; hence what idea can be formed of the shape of a nucleus atom from the shape of a crystal. It cannot be imagined an atom of matter is indented or otherwise than perfectly smooth, yet the crystal is indented; so that from other than crystaline forms is the shape of the atoms of matter to be inferred. However, as the whole of matter is inert and consists of the like substance therefore of unity of essence, its atoms, on the same simple principle, admit of being considered of unity of shape; and that the shape is spherical is the most rational conclusion, disproveable only by it being incompetent to answer universal purposes.

ELEMENTS.

MATTER being inert, homogeneous and its atoms of a common form, there is nothing to constitute an Element but atoms of the like size.

It may be conceived that all matter, before bodily formations out of it took place, was in the free, uncombined, elementary state, so that were its atoms of equal size throughout the equilibrium would be permanent and change impossible. But as all change is effected only by impulsive pressure, means must exist in the elements themselves for subverting the equilibrium on which the constant round of physical change depends. Hence in making the elements

h to another a minus-pressure means, from one be-
of greater rarity than another, the grand object is
ained. There can be no difference between ele-
nts of the same kind of matter but that of their
ng constituted of atoms of unequal size: and it
ll be found that one element is a minus-pressure
dium to another throughout the whole in the scale
descent.

That the atoms of matter are of different sizes is
o inferable from the following circumstances.
me atoms permeate bodies which to others are im-
rvious. The medium of vision is continuous through
dies impervious to all kinds of air. Ice is melted
a thick bar of iron placed on the fire; it acquires
ne species of elementary matter from the fire or
rts with elementary matter to the fire; which ever
y be the fact the matter passes through the iron.
e matter in question must consist of minuter atoms
n those of air; or, air has, in part, smaller atoms
n those of it which are not transmissible through
n. The respirable part of air permeates the mem-
ne of the lungs to arrive at the blood, the residue
not in consequence of being constituted of grosser
ms. The galvanic currents are so highly rare as
be considered imponderable, the atoms of these
d flame cannot be considered equally gross as those

of carbonic acid gas. A menstruum becomes sated, as it were, with one kind of substance, then with another and again with a third, and as the solution does not include the several substances but only their atoms, it is obvious the recipient interstices are of unequal size and the atoms they acquire are equally dissimilar, or the menstruum would be sated with the atoms of one to the exclusion of those of every other substance. On these data the conclusion is allowable that the atoms of matter are of unequal size; and as there is but atomic size to consititute any distinguishing characteristic of an element, it may be said, that, an element in Nature consists of the whole of the atoms possessed of equal size; an element in a body is the entire the body contains of atoms of the same size; and in the constitution of a body there are as many elements as it contains portions of the general elements. To which may be added, that as no single element, wholly or in part, exists in the bodily form, so, there is no body but what includes several elements, and hence that in Nature there is no such thing as a simple *body*. It is a silly test of simplicity a body being indecomposeable by art: and highly unphilosophical making elements of gold, phosphorous, charcoal and bodies of the like difficult decomposition. All bodies are compounds: body, in physics, is a noun of multitude. A simple body is as absurd as quaternity in unity.

Of the number of Elements it may be impossible ever to know. To assign characteristics to elements that possess but one difference, that of the size of their atoms, has its difficulties. It is only by strict observation of circumstance and constant effects wherein known characteristics are present and reproduceable by known means, that any particular element can be recognised and from the case derive a distinguishing appellation. The following attempt may afford the idea whereby somewhat of a nomenclature of elements might be composed.

Some one element consists of atoms of the largest size. This might be designated *The Grosser Element*. It admits also, from its implied general presence and service, of being named *The Nitrogen Element.*

That which makes the Nitrogen of atmospheric air respirable is a distinct element and may be designated *The Oxygen Element*; or, from its extreme rarity *The Oxi-electric Element.*

Hydrogen Gas may include one element which makes its other elementary matter have the peculiarity of Hydrogen. This may be termed *The Hydrogen Element.*

There may be two galvanic, two magnetic, and two elements peculiarly collected by the Electrifying machine, which admit of being designated according to how each kind is obtained.

There may possibly be Solar Elements, but nothing of the number supposed to be connected with the prismatic spectrum.

The Medium of Space is another Element. From being the cause of all phenomena it admits of being designated according to effects, *The Medium of Space, Motion, Force* or *Expansion:* and as it enters the densest bodies to produce expansion, the atoms of the Medium of Space should be considered the smallest of all atoms.

More elements than the foregoing, most probably, are included in the System, some of which a scrutinising attention to circumstances will in time unfold. Whatever the number of elements the whole may be said to be Electric excepting the Grosser Element and the Medium of Space. The term, Electric, will be found convenient in cases wherein the elementary matter transferred is not otherwise distinguishable. A body cannot experience change in its constitution without acquiring or losing some species of matter, so when the transferred substance is unknown, the texture of the body uninjured and the weight not altered, the term Electric is not inapplicable.

By *Electric*, is meant highly rare, of extreme tenuity; without acknowledgement of or reference to, in the slightest degree any of the manifold essential natures and properties erroneously conceived identical with electric currents according to the different modes and machines employed in their production.

The grosser atoms may be said to constitute the entire frame-work of bodies generally; these, from being under pressure, are necessarily in mutual contact; and from being spherical are productive of the largest interstices, into which minor atoms are forced, andwhich form smaller interstices that become similarly filled. Out of the smallest interstices the Medium of Space cannot be excluded, it is in all bodies as water in a sponge: as it is in quantity, therefore in force, more or less within a body, expansion by it is more or less effected. The interstices formed by the atoms of the Medium of Space are vacuities and the only vacuities in Nature. The torricellean vacuum is empty of air but full of the Medium of Space which is irremoveable. Wherever motion takes place the Medium of Motion is necessarily present.

POWER.

Power is that physical impulsive force which puts and keeps one or more bodies in motion and enables them to act forcibly on others. All power is physical and all effect is produced by physical force. Power or acting property not material, in physics, is a name for nothing, an absurdity. What are termed voluntary powers are productive of no physical effects, they are not the cause and but mere directors of the actions of the limbs, for without animal mechanism and the general pressure there can be no animal performance of the body promoted by mind or will. Power not material producing material effects, amounts to something being done by nothing. Whatever is in motion is physically impelled and kept in an acting state by its like, which although not sensibly known should be rationally inferred. Every thing in Nature is made to act and produce effects, but that which is a power is so no longer than while its acting state is being maintained. The tranquil pool is not a power, but when let fall it is a power to the millwheel. The air in a calm is no power, it neither moves the ship nor ripples the water, but when violently in motion it hurls whole cities to the deep. Even steam is powerless in the cylinder when shut off from the boiler of the engine. The medium of space is powerless unless as the equilibrium of its pressure is subverted.

The Power of Nature consists in the pressure of the universal medium, which however originated, is maintained, it is presumeable, by the general effects of which it is productive, and, as it now exists may be said to commence every where but end no where. By minus-pressure means it becomes occasionally and partially disturbed, and by minus-pressure means the equilibrium, productive of partial rest, is restored. Nothing but the general pressure can produce similar physical effects every where on inert matter and bodies ; and nothing but change of pressure can be the immediate effect promoted by the heavenly bodies which causes a planet to be affected by another.

Matter being inert all things formed of it are inert; nothing can act of itself; so wherever action takes place the immediate power is the pressure of the medium of space. As similar phenomena are attributable every where to the like cause, and as Nature cannot have several similar causes nor other than a common cause for the whole, so, to the pressure of the medium of space all physical change may with certainty be referred. The medium of space being every where and pervading all manner of bodies, in consequence of its atoms being smaller than the smallest interstices, it is in immediate contact with every body and every molecule in Nature: it is a species of back-spring impelling the planets, and, in every instance of its equilibrium being disturbed, puts bodies into motion or displaces their atoms. No other cause or power is requisite to maintain the interminable round of local change productive of the phenomena of Nature or the Universe. How matter acquired its state of pressure may never be ascertained, nor is the knowledge indispensable to the right understanding of any physical circumstance whatever. It is the only mystery in Philosophy that affords no resting place for conjecture. That atmospheric pressure exists is evident and as planetary phenomena are similar to projectile effects within the atmosphere, there can be no hesitation in concluding the whole are similarly caused, and not by distinct causes, but one pervading the whole expanse where such effects are promoted.

Effects are said to be proportional to their causes. This assumed dynamic axiom has contributed no little towards the power of nature, the universal cause of motion, remaining an object of so little enquiry. As the greater the previous impulse, it is said, so is the effect, and as a planet from a proportional or temporary impulse cannot stop itself, it must move for ever if not resisted and therefore space is a vacuum. The fact however is, effects are necessarily equal to their cause, therefore an effect is the measure of its cause and to every effect its equal of cause is attributable. Therefore planetary motion depends on a constantly impelling cause.

There is no effect but what consists in motion: no effect can be produced on matter but local change. With motion ending all effect has terminated and the production is *result.* The impression on wax is not the effect of the seal being impressed but result; the motion the wax is put into constitutes the effect; when, the wax ceases to be moved downwards and upwards into the cavities of the seal the effect is at an end: otherwise in the impressed wax there is an enduring effect without an enduring or equal cause. The finished impression is the result of the terminated act and effect. As long as motion is continued, planetary for instance, there is no result.

An effect cannot be either greater or less than its cause: to be greater all excess is so much uncaused effect: the effect cannot exceed the force by which it is produced or there is something produced by nothing, an effect exceeding its cause. An effect less than its cause is an absurdity; it implies that its cause, under the same circumstances, could produce a greater effect; that the cause acting immediately and fully on the body acts on it only in part. The mistake lies in imagining the whole of the power employed is concerned in producing the effect and result; whereas the quantity of the power employed in producing the effect is no more than that which overcomes the resistance and produces the effect motion—the portion of the whole of the force to which the resistance yields, which may be but a little more than the equal of the resistance; the surplus power is wasted. Wherefore as cause and effect are in all cases equal, as long as effect, motion, continues, impulsive means are concerned in maintaining it; which implies an impelling cause in immediate contact with that on which the immediate effect motion is produced. As long as planetary motion continues there is an equal producing cause as constantly impelling the planets, the force of which on each is productive of effects *ad infinitum* the whole of which consist in motion, the result cannot be known until all effects cease by their general cause ceasing to act, an event foreign to the order of the universe and only to be effected by unconnecting the parts and sending each into unplanetted empty regions, or the annihilation of matter.

The expression, action and re-action are equal, carries with it something like the original force generating a force in the opposite direction, or, that re-action is an induced returning force; and that every act is equally acted against. A body acts only from being impelled, there can be counter or re-action on its part; and if met by a body in a similar state, it is action against action, there is no re-action,—which might be interpreted, in reflected motion particularly, acting backwards—in the case. Two cannon shot meeting in the air mutually act on each other in opposite directions. If a shot be fired against a wall and after impact rebound, if this be defined re-action yet it is not equal to the original act, to be equal the shot should be returned to the gun. Then what re-acts, not the motionless wall, but some intermediate cause, which is that by which all impulsive effects are produced. If the ball after impact do not rebound but fall down to the foot of the wall, where is the re-action, motionless resistance is neither act nor re-act. So far then it appears the [*]expression action and re-action being equal, does not apply to the fact nor accord with the ideas it suggests.

That action and resistance to action are equal is obvious, from resistance yielding to, what may be said, its equal of force however much greater may be the whole force. Two bodies of equal momenta meeting and coming to rest after impact, have resisted each other equally, each destroyed the other's force and neither produced the effect motion on the other. Two of unequal momenta meeting in the air and the lesser one falling after impact, by its resistance it has destroyed neither more nor less of the greater momentum than the equal of its own force, and by falling it is obvious the greater momentum acted on it only in an equal degree. Were the less body after impact impelled forward by the greater it would be by the remaining unresisted force of the greater, the amount of which is the whole original force less the resistance or force of the lesser body. A shot stopped by a wall is resisted but the equal of its impinging force; were its resistance less the wall could not stop its progress, were it greater, still the shot must stop as soon as its force is equally opposed.

The general pressure when subverted partially on a body is the power or cause of continuous motion. In this state of unequal pressure are all the planets and comets and the smallest grain of dust while in motion. It is the cause also of weight, which is manifest by a body acquiring weight in the direction it is in motion, that is, most strongly impressed, and losing weight in the direction of inferior pressure. Thus, when an ounce, from being let fall into an empty scale counterbalances a pound in the opposite scale, it is then of equal weight to the pound, and if let fall from a greater height would exceed in weight that of the pound. While the scales are in equilibrio the weights are equal, when the ounce scale preponderates the smaller body is of the greater weight. A large shot sinks a weigh bridge a certain degree while at rest on the bridge, but sinks it much less when forcibly rolled over it; the unequal pressure which moves it gives it weight or momentum in the direction it is applied which lessens its downward weight. Hence it is obvious that what alters, increases and lessens weight is the cause of weight. There cannot be two general causes of weight. Matter is not naturally ponderable: the strength of a fly could move the largest planet in empty space and make it ponderable in the direction of motion. As a general power the general pressure is all-sufficient. It acts in all directions, as motion implies, and at command in every direction accordingly as means are applied to subvert the equilibrium. It is diverted from acting vertically according to the violence of the wind.

It is lessened by a current of wind from a bellows when passed over the upper orifice of a tube the lower being immersed in water, the water rises instantaneously—to the height equal to atmospheric pressure were the tube sufficiently long—and is blown out at top. The desideratum is to produce a constant blast of sufficient diameter at less expense than water can be lifted, to obtain a fall or facilitate drainage. The sap in trees is affected similarly by high winds. The extra-ordinaries of Nature are all produced by physical force that nothing can account for but a universal medium of pressure.

In adopting as power the pressure of the Medium of Space there is nothing assumed. Space must have a medium of motion, from which the atmospheres of the planets cannot be free and to which all motion is rationally referable. Pressure is indispensable to the Universe, known every where to exist and its origin is no question. With universal attraction universal pressure is required, without it all phenomena are such as a state of general pressure could produce. Therefore, in the words of Newton, we are warranted in referring the whole round of common effects to the same common cause.

ELECTRIC ATMOSPHERES.

All bodies being constituted of spherical atoms, there can be no physical plane, no surface however glassy smooth but what consists of atomic projections and indentures, caused by the exterior stratum of its spherical atoms; nor any surface but what has its indentures occupied by suitable electric atoms, which latter, in consequence of forming minor interstices, admit the addition of still minor atoms. All being under pressure and the atoms of every kind of elementary matter abounding in quantity, unoccupied interstices is a physical impossibility, those only of the Medium of Space excepted from the atoms forming them being the smallest in Nature. The electric matter thuswise accumulated forms a velvet-like pile or electric atmosphere on the surface of bodies. The following cases afford practical evidence that such is the natural fact.

A dry polished needle floats on or rather over water. It does not touch the water but lies embedded in it partly beneath the surface, and so distant is the water from it on all sides that some insects could walk round the needle without touching the water as round a globe in an atmosphere of air. Something substantive must keep the water at a distance from the needle, support the pariettes of the furrow from caving in and prevent the needle resting immediately on the water. This intervening substance is the needle's electric atmosphere, perhaps in this instance collected from the water and retained by the needle in its almost insulated state. Now, as to remove air from a vessel water effects the displacement, so to remove the needle's atmosphere wetting or blackening the needle is productive of the like result, and in either case the needle does not float but sink. Newtonians say the furrow is caused by the repulsive film or power of the needle; then why should wetting the needle remove this elementary quality when it is not destroyed by the water on which the needle is placed; and whence comes another film when the needle is again made dry. The film is only in the mind's eye, it is but a cataract of the understanding for which rational couching is the only remedy. A stratum of inert electric matter is more reasonable than of the by-named film of repulsion. Were the buoyancy caused by the water it could not be affected were the needle wet or dry, polished or blackened.

But there is more than buoyancy of the water in the case, the cavity being so much greater than the needle and the needle being some distance from, not on, the water. More water is displaced when the needle floats than when wholly submerged. Had the needle n its dry polished state an electric atmosphere removeable by water and the soot formed by flame, the Illustration of the phenomenon would be as described, the needle and its atmosphere would make a furrow n the water the electric atmosphere resting on the water the needle on the atmosphere.

It is known that several bodies may be plunged into water and brought out dry, but brought out wet f rubbed while under water. Something on them keeps the water off, which is their electric atmospheres. Glass has no more of an electric atmosphere, apparently, than a polished needle; but what else is taken from the Cylinder or Plate of the Machine by the scraping of the rubber, which the conductor conveys to the Leyden Vial, with which the vial becomes charged, which it looses when discharged and which the Cylinder has renewed on it from the atmosphere as constantly as it is de-electrised by means of the rubber. Here I go by the modern theory of Electricity, but question if the jar be not de-electrised eventually to supply the cylinder made deficient by the rubber.

Dew-drops roll over the leaves of plants without wetting or even touching them, and as Newton's meniscus lens required force to bring it into close contact with the plane on which it rested, it is obvious a film or stratum of electric matter must have lain between, and so with the drops of dew. Were a film of repulsion concerned, dew-drops could not remain on the under side of a leaf, yet there they are to be found neither repelled away by a film nor attracted downwards by the Earth. A film of repulsion, or stratum of force, should have prevented the drops being formed.

Glass is a non-conductor, that is, retainer of electric matter, to remove which it is that great weights are applied to the amalgam in the manufacturing of plane Mirrors. In picture frame gilding water is used to displace superficial electric matter, in order that when the water becomes evaporated the gold leaf shall be in immediate contact with the frame, then it is retained firmly on the frame by external pressure: so were perfect planes of any two bodies brought in immediate contact throughout, the two would then be as one body. Electric atmospheres, like dust, are a hinderance to the immediate contact of two bodies. Quicksilver is used in metal gilding as water in frame gilding, there is nothing adhesive in it; besides, it is got rid of from the amalgam by fire, leaving the gold in immediate contact with the metal, and from there being nothing existing between, the gold, from the force of external pressure, remains part of the metal. Cements, glue and paste are useful on the same principle, and when desiccated the force required to separate the compressed parts is greater than their individual tenacity : external pressure, not attraction, is the cohering force. When two leaves of paper are rubbed by a piece of India rubber they seem to stick together, owing to their electric atmospheres having been removed, which leaves them in closer contact also under greater pressure externally than before, owing to electric matter being a minus-pressure means. Without rubbing, wet paper is similarly compressed and there is nothing viscous, sticky or adhesive in water. The pressure on two rubbed leaves being increased by displacing the superficial matter ; is an instance of the law, that, *Electric matter lessens pressure.* To the electric atmospheres gradually increasing on the surface of polished bodies, is owing the substance termed tarnish, the removal of which is effected by rubbing. If this be the first stage of oxidation, it may lead to some degree of knowledge of wherein consists the oxigen element or if tarnishing be oxiding : by placing different bodies, each in a limited portion of dissimilar airs, their tarnish may be ascertained as oxidation or not. It is the electric atmosphere on a smith's anvil, which, when disturbed on one side by the slight stroke of a key, agitates small seeds on the horizontal surface. The electric matter connected with glass when set free, is what promotes the agitation of water in a tumbler as the edge is being rubbed round by the moist finger; the idea of the glass vibrating is unreasonable.

The fact, that, as is the surface of the Cylinder or Plate so is the quantity of Electricity obtainable, and that electric phenomena are produced in every change of the constitution of bodies, in all cases of formation and decomposition, is convincing that all bodies retain minor elementary matter on their surfaces as well as in their interstices; the consequences of which to the electrometer have contributed mainly to establish the Science of Electricity, a Science teeming with facts of almost as difficult interpretation as those of magnetism.

The atmospheres of planets afford strong indication of the like being common to lesser bodies, and as the utility of the former is incalculable, those of terrestrial bodies, it will be found, are tributary to general service.

MINUS PRESSURE MEANS.

As Nature has not a variety of causes, powers and forces, but all in one, the Medium of Space, and this being uniformly at the maximum, means are of necessity included in the system to counteract the maximum, to mitigate its force so as to produce variety of results, to promote the state of unequal pressure on which continuous motion depends, in a word, to prevent the equilibrium taking place which would leave all things at rest.

Weight being momentum and with bodies as the quantity of matter in each, the different weights of equal volumes of matter is owing to the atoms of the heavier being larger than those of the smaller volume. From which it is deducible, that, as the smaller the atoms the less degree of pressure a body is under, so, according to the medium in which the body is involved is the pressure on the body. A body is under greater pressure in quicksilver than water, greater under water than air and greater under air than electric matter: from which it follows, that when involved or surrounded by the grosser element in its uncombined state the body is under greater pressure than when surrounded by an element of smaller atoms. Therefore every element, but that of largest atoms or the grosser element, is a minus-pressure medium to the body it surrounds and differently such according to the size of its atoms. This being granted, it follows, that, the portion of a body, or of the surface of a body, which is possessed of minus-pressure matter is under less pressure than that which may have none.

A polished needle is supported on water while it retains its electric atmosphere; it is under less pressure while floating than when, by any means, its atmosphere is removed which promotes it being precipitated. Hence the electric atmosphere is manifestly a minus-pressure means. There is no ascent of water in capillary tubes when de-electrised there being no minus-pressure matter within them. To the Faculty it belongs particularly the application of the principle in accounting for the ascent of the blood in the veins. Doctor Barry wisely advocated pressure, rejecting the vague imaginary nominal stimulus. To this hint may be added, that, as the electric matter in a pledget of lint is a minus-pressure means in promoting the rise of blisters, and as moisture on two plates of glass inclined acutely to each other promotes the rise of water between both, so may the mucilages on the veins, arteries and organs of the body generally, be minus-pressure means whereby the unequal pressure necessary to promote motion and the animal functions, is brought about.

In combustion, which is decomposition by means productive of fire, the elements of the combustible body are set free, the most rare of which constitute the highly rare minus-pressure medium attendant on fire. Water rises in a tube over which fire is placed; were the fire repellent there could be no ascent: the fire being removed the water falls, when replaced it again rises: the promoting means are doubtless the minus-pressure medium of fire. This extremely rare medium is itself under the general pressure, yet as it promotes ascent it is not pressed on the water within the tube equally as the atmosphere presses the external water, consequently it is a minus-pressure means. The phenomenon is perfectly independent of the fire or the atoms of its medium being hot. The minus-pressure matter of the medium of fire intercepts, as it were, the general pressure over the water within the tube.

When a charged jar is presented to water the latter rises beneath it in the form of a small cone. As the jar is being moved over the surface of the water the cone follows it, but if the jar be suddenly discharged the cone falls: hence to the electric matter of the charge and the general pressure, only, can be ascribed the equilibrium being disturbed productive of the ascent: the electric matter therefore of which the charge consists is the minus-pressure means. Astronomers can best determine, whether the Sun and Moon be not as the charged jar to the Ocean and each a minus-pressure means in promoting the elevation of the water whence the Tides are produced.

Other instances may be advanced of effects promoted by similar minus-pressure means, such as, floating bodies coming, as it were, together of their own accord, also in the calmest weather being pressed towards the land; which is evidently the consequence of the bodies being under unequal pressure on opposite sides. So that it may be considered the general fact, that one body, by means of its electric atmosphere, lessens the general pressure on another in its neighbourhood, as a wall shelters us from the pressure of the wind; and that all effects, from consisting in motion resulting from universal pressure, are promoted by minus-pressure electric matter. On this principle, not attraction and repulsion, depends magnetic motion: also the deviation of the pendulum at the side of a mountain out of the perpendicular; which latter is proved by the deviation being greater or less according to the time of day the experiment is performed or as the mountain has more or less of mist about it, that is, of minus-pressure electric matter. To which may be added the variable weight of the atmosphere, from the fields of electric matter continually floating through and passing into the opposite hemisphere. Not only is the general pressure lessened on bodies by free electric matter and the electric atmospheres of intervening bodies, it is also made to act more forcibly on one side of a body than another according to the side that becomes de-electrised or partially deprived of its minus-pressure matter.

The great Water Spout is similarly promoted. Electric matter, in the form of an inverted cone, descends from a cloud and when sufficiently low the water beneath is forced into it to a considerable height. In this instance particularly, it cannot be imagined the funnel-like cone contains air rarefied by heat. On the water the general pressure must have been lessened and by the interposition of the cone, for when the latter is broken by cannon shot or agitating the air the spout falls.

On the minus-pressure principle it is conceivable, that, were the tail of a Comet sufficiently near the

Earth the whole of the Ocean and all its tributary streams would be forced into it so as to form one immense column, which, as the Comet receded, would fall and be productive of another general deluge with its fatal consequences, leaving the water timely to subside into its former different basons.

FIRE.

By Fire is generally understood a body, or several bodies together, sated with heat. Newton considered that to be fire, which, whether ignited or unignited, warms the hand, alters bodies and ignites gunpowder by its heat, such as iron a short time in the fire and charcoal just made but not ignited. That there is fire is as undeniable as that there are iron, coal, wood and flame, but, that it is hot, warms the hands and explodes gunpowder by its heat, is as contrary to the natural fact as it is true there is no elementary matter permanently hot, nor possibility of making unalterable matter hot.

A culinary fire is inactive in itself although it promotes the decomposition of bodies. Its combustion is but a state of the fuel while parting with its constituent elements; and the continuance of the state depends not only on the addition of atmospheric air, but of the medium of space within and constantly increasing in the fuel, the centrifugal pressure of which medium is the decomposing force or cause.

While a body exists as fire it is in a *deficient state;* it has been rendered unsated; it has been deprived of some of its elementary matter, hence the expression, *de-electrised.* The like of what it has lost the medium surrounding it acquires from all bodies placed in contact with fire, and the de-electrised state is the first stage towards combustion. The ignited fuel acquires similar matter from the hand, the loss of which from the nerves of sensation is productive ultimately in the mind of the sensation of heat, which makes it be thought the hand has received heat from the fire, than which there is nothing less true.

The rarest of the elementary matter which escapes, or rather is forced out of the fuel by the pressure of the medium of space within the fuel, becomes a minus-pressure medium attendant on fire, and as such promotes expansion and other changes which bodies undergo when in contact with fire: it lessens external and thereby promotes internal pressure.

A body in contact with fire becomes de-electrised first, that is, deprived of its free electric matter, the place of which is supplied by an influx proportionally of the medium of space. In this state its atoms are under greater internal than external pressure, and as these circumstances proceed the body becomes decomposed or it is fluidified.

All bodies contain more or less of freely removeable electric elementary matter in their interstices according to the state of the atmosphere or medium in which they are circumstanced; and in their smallest interstices acquire the medium of space from without, which enters more and more as de-electrisation by fire proceeds and is the cause of de-electrising bodies in the promoting minus-pressure-medium of fire.

While it is imagined bodies acquire heat or matter of heat communicated to them by fire, the contrary is the fact, there is nothing communicated or radicated by fire, all bodies in the neighbourhood of fire suffer loss. That all bodies suffer loss is made evident in things scorched, charred, reduced in quantity and weight and destroyed by fire; and while fire promotes loss universally, it cannot in reason be maintained it acts contrariwise at the same time, it cannot take from and communicate at the same time. The medium of space cannot be pressing matter into and out of the same body all at once. Fire has no communicating power; the atoms in which bodies in the state of fire exist being essentially inert, neither repellency nor radiation is a property of fire.

That all manner of bodies undergo loss by fire is made manifest, first in case of Solids. Of solid bodies that are combustible the entire of their substance is removed: the residuum of wood and coal is not wood and coal but each a subsequent formation, ashes are not in either coal or wood. Charcoal is evidently wood which has suffered loss, cinders are coals reduced in quantity. Even the iron bars of stoves and ends of pokers become in time considerably reduced by fire. All culinary vessels are made thin and reduced to holes by fire, as are the thickest plates of the steam-engine boiler, the thinest most quickly. Charcoal is wood less than the original coal. The tinder of linen and paper proves loss by fire. Damp clothes become desiccated by fire and the humidity removed is driven in the direction of the minus-pressure medium of fire. The entire substance of a candle is displaced by means of the fire at top. Hence as some solids have the entire of their substance displaced and as effects by fire are uniform, that is bodies losing matter, so when the only change a body has undergone is the making it appear warm, nothing but inappreciable free electric matter from its surface and interior has been displaced. As the body appears more warm its deficiency of free elementary matter is the greater and the loss to the hand touching the body is also greater. So far it appears certain that solids suffer loss by fire. That fluids suffer loss is evinced by water when placed in a vessel on a culinary fire. The elementary matter of which it is deprived is forced downwards towards the fire and on the bottom of the vessel is recognised in the form of air bubbles. With such the bottom and sides appear beautifully beaded, which beads do not, nor can they be made ascend either by removing them with a feather or agitating the water. Were they formed of air their dispersion from the bottom and sides would be inevitable; and had they been communicated by the fire, after having permeated the rigid substance of the bottom of the vessel, they must have mixed with or escaped upwards from the water. The quantity increases until the bottom of the vessel has itself been sufficiently de-electrised, or rendered so porous by the loss it suffers, as to permit the whole freely escaping downwards in the direction of the fire. While on the bottom, if the vessel be removed from the fire, these aeriform spherules gradually disappear, not however by escaping into the air or even rising in the water but mixing with the water. It is the expanding cause the medium of space flowing forcibly in as de-electrisation proceeds which produces other ascending bubbles and causes ebullition.

Water on a fire becomes de-electrised; it has its free electric matter forced into the minus-pressure medium of fire, it is then in a deficient state and supplies its deficiency from the bodies that may be placed in it: hence it has forced into it the juices of animal matter, and from being more deficient as it approaches the boiling point, it is, up to 212°, in a more fit state to extract, as it were, and thereby promote infusion and solution. The water must lose something to make room for what it acquires of the included bodies, or at 32° it should be as good a solvent as at 212°, cold being nothing material nor even a state of matter. Matter of heat, whether hot or not so, added to water ought to prevent solvency by filling the interstices of the water. Hence as there is every reason for concluding fire promotes loss of elementary matter from water, therefore from all fluids. That airs suffer loss by fire, is evident in the oxiding of quicksilver at the expense of the air, and from a candle burning in a limited quantity of air, wherein if the air be not lessened in volume it is manifestly in weight the equal of what the result has acquired, particularly in the first mentioned case. Fire cannot continue in combustion but as it deprives the surrounding air of its respirable oxygen element. Even the mere ignited state depends on free access of oxygen which the air loses; for wood may be charred without being ignited, but when taken out of the crucible immediately from the fire it becomes ignited at the expense of or loss from the air of its oxygen. Then as solids, fluids and airs suffer loss when in contact with fire, it is obvious the law is general; and the contrary, or, that fire communicates any thing to bodies is not the fact and inconsistent with the general procedure.

The following instances exemplify further and more particularly the truth of the general law, that, bodies suffer loss by fire. A polished needle floats on water, but when ignited sinks in consequence of fire having deprived it of its electric atmosphere. As we rub away dust and sand from surfaccs when wanting to promote contact, so, we hold a body, going to be varnished, before the fire, not to heat it nor solely to keep the varnish fluid, but to remove all intervening electric matter. The cylinder of the electrifying machine contributes little or no electric matter to the conductor when too near a fire, the fire or the medium round it acquires nearly the whole. Flame becomes extinguished when surrounded with a small metallic ring, considered cold, by acquiring from it electric matter injurious to flame, but remains uninjured if the ring be ignited. In the first instance the ring is sated with electric matter, in the second it has been rendered deficient of the same by the fire by which it was ignited. Water does not run freely down a bar of iron, but runs rapidly when the bar has been deprived by fire of its superficial electric matter : in the latter state the bar has been de-electrised and is deficient. Ignited iron when plunged into water acquires from the water that which makes it unignited and of which it had been rendered deficient by fire, which leaves the water deficient; so when the hand is placed in the water it contributes free electric matter towards supplying the deficiency of the water, and from the resulting sensation being that of heat, it is concluded the iron has communicated heat to the water. Water does not flow through a capillary tube unless it or the tube has been de-electrised by fire, the electric atmosphere, within the tube, is the hinderance, which matter the water in its deficient state acquires. It is not cooling is effected by blowing on an ignited body, but adding to it elementary matter similar to what it lost, although not the whole, in becoming ignited. Iron becomes ignited by percussion, not by beating cold out, nor heat in, but displacing electric matter for the reception of the oxygen element, as beating water out of wet sponge permits the air to enter in its place. An ignited body becomes unignited by what it acquires from the air and to be re-ignited it must again be de-electrised by fire. Friction and beating the hands against the sides promote de-electrisation and the feeling is that of heat: heat is not beat into but electric matter out of the hands. The electric matter removed, when within the hand, promotes the sensation of cold, it is got rid of by exercise, and kept out of the body by furs and woollens, which, from retaining much electric matter makes them preventers or non-conductors. Of this kind of matter the air at the line is greatly deficient, by which the human body is retained in a constantly de-electrised or deficient state; and as even there freezing is effected, it is obvious congelation does not depend on the absence of physical heat. The sensation of heat being excited by various modes in the absence of fire none of which tend towards contributing matter to the animal frame; combustion being promoted by mere friction, and ignition by percussion; fluids and airs losing elementary matter by means of fire, it cannot but be the general law, that bodies acquire nothing from fire but in every instance suffer loss.

EXPANSION.

HITHERTO only the means of promoting action have been noticed, now action by the Common Cause and promoting means comes to be practically exemplified.

Expansion is considered the effect of heat entering a body. So far there is correctness in the idea as that without something entering the body its expansion is impossible; but the expanding cause is not heat nor any thing communicated by fire, neither is that hot which expands an ignited body any more than that which expands water during congelation: the cause is the same in both cases and neither hot nor cold. The Medium of Space is the expanding cause universally.

A body in contact with fire becomes expanded. Something has entered it to force its elementary atoms asunder and enlarge its volume. Previously to which something must have been made to vacate the interstices of the body for the expanding cause to find admittance. That which expands the body must be in a state of force and not isolated but continuous thence with the external medium of force, that is, of space. As expansion increases the cause must be on the increase within the body and fill the enlarged spaces it makes between the atoms of the body. To effect the whole of which, it will be found, that as the expanding cause or medium finds entrance in excess, the body is undergoing de-electrisation more and more in the minus-pressure medium of fire; it has forced out of it the free elementary matter occupying the interstices of its grosser atoms. The matter displaced, while within the body is the hinderance to the expanding cause entering it previously to the de-electrising process taking place.

On these principles the *rationale* of expansion is simply this : a body placed in the minus-pressure medium of fire becomes de-electrised by the centrifugal pressure of the portion of the medium of space it contains in its smallest interstices, which medium, from being continuous with the like without, is under pressure, and as electric matter continues to be forced out the medium of space enters in greater quantity, the force of which being as the quantity makes expansion on the increase.

A body in its naturally contracted state has the medium of pressure in its minutest interstices and the same is connected with the like medium generally:

the quantity is small and its force insufficient to cause expansion, but would be more only that the interstices of the body are occupied by free minus-pressure electric matter to the exclusion proportionally of the medium of space. From which it may be looked upon as a general law in physics, that, electric or minus-pressure matter is a preventive against a body containing an excess of the expanding medium or of the medium of space; it excludes, its equal at least, of the medium of space and in doing so is the preventive against expansion. Hence to promote expansion electric matter must be displaced and then from the body acquiring the medium of space in excess expansion follows.

The minus-pressure medium of fire may be said to prepare the body for the reception of an increase of the Medium of Space, the portion of which within the body, from being under pressure from without, forces electric matter centrifugally out of the body into the medium of fire, which makes room for more of the expanding medium entering the centrifugal pressure of which enlarges the volume of the body. During expansion, the centrifugal internal, is greater than external pressure on the body. The medium of fire is not merely a minus-pressure means,—or in vacuums of art the body should be expanded,—it is also one that presents interstices for the atoms generally of the body, the whole of which are forced into it when the expanding process is continued to the extreme, that is, when the result is aeriform. When the body is removed from the fire it becomes gradually contracted, in consequence of the expanding medium being forced out by returning electric matter being forced into the body. If, in this contracted state weight has been nothing lessened during the expanding process, it is because none of the grosser atoms of the body have been removed and electric matter only displaced. As contraction proceeds internal pressure declines, leaving external pressure as it were on the increase. The returning electric matter may not be the whole displaced but some kind always returns: a piece of polished metal, after ignition, expansion and contraction, exhibits, in its roughness, irrecoverable loss from its surface without loss of weight.

Bodies being formed of spherical atoms, and the medium of space consisting of the minutest atoms, no body however sated with electric matter is impervious altogether to the medium of space; and the portion within the body cannot be insulated from the like medium without in space generally: so that the most dense, most contracted body has its atoms under centrifugal pressure in some degree, while the whole, as a body, are under centripetal pressure in a much greater. And as the contracted body contains free electric matter in its interstices, which elementary matter is under the general pressure yet the body is not expanded nor until de-electrised does it become expanded, it is manifest not only that, electric matter is not the expanding cause and that it excludes the expanding cause, but that it intercepts the force of the general pressure.

In all cases the procedure is similar. In frosty weather, without the agency of fire, with and without humidity, rocks become rent, owing to the air promoting the forced escape of minor elementary matter and the consequent influx of the medium of space. A vessel only half full of water has its contents expanded to overflowing; in which case no part of the vessel is empty and the whole which fills it cannot be considered water; the atoms of the water have not swelled; neither is air the expanding cause, for were boiling water reduced to 32° in vacuo and then boiled again in vacuo, it would again be expanded. The water has suffered loss of elementary matter and acquired in its place the medium of space by the pressure of which in every direction the fluid is expanded. The thermometric fluid before an ignited body is expanded by the like means not by radiated heat: it acquires nothing from the ignited body; there is no radiation or communication of heat nor heat to radiate: the fluid in the tube has its free elementary matter forced out into the minus-pressure medium of fire—that of the ignited body—by the medium of space, which latter continues to expand the fluid as de-electrisation proceeds, and as it enters forcibly more and more in quantity the expansion by it is the greater. In the sunshine or any where in the open air the means and mode whereby thermometric changes are effected are similar; de-electrisation succeeded by the expanding cause. The proceeding is reversed when the fluid descends; returning electric matter is then accumulating in the fluid and displacing the expanding medium. The pressure of the medium of space it is which forces electric matter both out and into the fluid, and the medium in which the thermometer is circumstanced constitutes the minus-pressure promoting means.

Air being expanded in a flaccid bladder in vacuo, shows how little repellent heat is concerned. As the receiver becomes exhausted external pressure is lessened on the air within the bladder, into which the medium of space enters, inflates and ultimately bursts the bladder. For the common effect, expanding, no more than a single general cause is necessary, whether fire or congelation promote the phenomenon. As the atoms of air in the bladder cannot fly asunder nor be separate, and as air cannot enter the bladder, still as it has been filled there is no alternative but that of the medium of space being the expanding cause.

As air is being let into the receiver the pressure it is under forces all excess of the expanding medium out of the bladder and reduces its contents to their former volume. The space within the bladder in its expanding state is a plenum; perfect vacuity in any part is absurd to imagine while a general result has been effected by cause as general; and that which constitutes the plenum must be continuous thence through the bladder to make it act forcibly and centrifugally on the interior surface of the bladder. A bottle full of air retains the cork unmoved, so when the cork is blown out, by placing the bottle near a fire, something, not air, must have forcibly entered through the sides of the bottle, and which, from being continuous from without and flowing into the included air forces electric matter out of the air into the medium of fire, mixes with the atoms of air in the bottle, forces them violently asunder in all directions and in consequence discharges the cork.

A limited quantity of air in the air-pump receiver when reduced one half yet still filling every part of the vessel is accounted for on principles nothing short of marvellous. It is said air is so elastic, that, when free to expand, the smallest quantity can fill the largest space: but what expands it; wherein consists the elasticity of its hard unalterable atoms, and how, in any respect, can a part be equal to the whole. It has been asserted that so much air might be compressed into a needle's eye, as when set free would suffice for an atmosphere to the Earth, than which there can be nothing more erroneous. The atoms of air being under pressure must of necessity be in closest contact one with another or with the atoms of the medium of space in which they are included; and were this medium not removeable from the air or the air itself through the pore of the condensing syringe, the whole force of Nature could not reduce the volume of the included air, it could not press down the piston the smallest degree. The included air is reduced in volume in consequence of it being lessened in quantity. The piston when pressed downwards forces the medium of space out of the included air through the pores of the syringe, and the piston when set free is forced upwards by the medium of space returning through the sides of pores into the syringe. The resistance to the piston being depressed and the force, independent of the hand, by which it is lifted, are caused by the pressure of the medium of space, not elasticity of the air or of its atoms. Were the experiment tried with the syringe under water, doubtless the forced out matter would be somehow sensibly made known. The absurdity of the notion that a small part of the atmosphere is sufficient to make an entire atmosphere is obvious. The needle's-eye full so applied would have its atoms some thousands of miles asunder. So that the miraculous elasticity, compressibility and self-expansibility of air are wholly imaginary properties. Were the atoms of matter elastic all bodies would be not only compressible but elastic. Some *bodies* are elastic although none of their atoms are so, metallic springs for instance; but this is owing to electric matter being squeezed out from the side made concave, so that when the spring is let free the medium of pressure enters the vacated interstices and forces the spring back into its former position. Bending a curved spring in the contrary direction is difficult, because grosser atoms are pressed against grosser atoms on the convex side which do not readily give way; during which the atoms on the concave side are separated and those above made eventually to give way to the applied force, in consequence of which the spring becomes wholly disunited or broken.

That the medium of space is the expanding cause is inferable, first, from what has been said of bodies being sated with electric matter and being under the general pressure yet not expanded; therefore electric matter is not the expanding cause. Secondly, bodies lose of their substance by means of fire, which proves the cause of expansion is not communicated by fire. Thirdly, expansion in the air-pump receiver is promoted by removing air and the pressure of air, and the expansion of glass and metals into which air cannot enter, are so many proofs air is not the expanding cause. Then as expanding is but forcibly impressing and putting in motion in a centrifugal direction the atoms of airs, fluids and solids, the cause is justly referable to the medium of force and motion. For it cannot be maintained there is a different cause for great and less motion, for every direction of motion and degree of force.

Thus, it will be found, that, as all effects consist in motion produced by the medium of space, all phenomena whatever have somewhat of similarity in their states of production and in their promoting means; so that a single instance understood in all its immediate connection is explanatory of the principles of the whole.

IGNITION.

HEAT, colour and luminousness being sensations, their like cannot belong to bodies.

A body is said to be ignited when it promotes the sensation of heat and the sensation named red.

Oxygen is indispensable to ignition. In the absence of oxygen a body may promote the sensation of heat and not that of redness or luminousness; as charcoal just taken from under melted lead, and the wick of a candle while surrounded by the flame which insulates it from the surrounding air, each of which when introduced into the air becomes ignited.

The state of ignition is effected by the body becoming de-electrised by fire to such an excess as fits it for acquiring the oxi-electric element as well as the medium of space or expanding medium.

As ignition proceeds the body approaches to transparency. A plate of iron, ignited by means of fire or percussion is, in a degree, transparent, for if the smith's hammer be passed along it at one side while the plate is vertically posited, at the other side we know visually of the act and imagine we see through the iron.

A transparent body being one through which the visual medium is uninterruptedly continuous, a semi-transparent body has this medium but indirectly continuous through it. To remove cloudiness from a crystal and promote transparency, the stone is placed in fire to be de-electrised and oxygen is excluded. To make a transparent vitrifaction much oxygen is added to the materials in the vitrifying process, previously to which much electric matter has been thrown off and much smoke formed. Finally, as the colours excited in the mind by means of the prism depend on the visual medium being continuous through that instrument indirectly and most probably somewhat curvilinearly, by which the optic pressure on the sense is productive of what is considered coloured light, in like manner the indirect visual continuity through the ignited plate is productive of the sensation of colour known as red, which is equally a mental effect that may be termed prismatic.

From the foregoing premises it would appear that the state of ignition is produced after the following manner. A piece of iron in the fire suffers loss of elementary matter first; in place of which it acquires the expanding medium which is also that of vision, together with the oxygen element, the interstices of the atoms of the latter are such as exclude all returning electric matter; and, as the medium of vision is more or less directly continuous through it, the ignited iron is more or less transparent. The resulting mental effect, by means of the visual and feeling senses, causes us to imagine the iron is red and hot.

An ignited body becomes unignited when removed from the minus-pressure medium of fire, by reason of all excess of the expanding or visual medium being forced out which forces with it the oxygen element, and by the body acquiring from the air its natural quantity of free electric matter. Blowing wind on an unignited coal hastens the decline of ignition by forcing, more rapidly, into it free electric matter than would be its return by atmospheric pressure.

Ignited charcoal and iron seem, to us, of the like colour, but, when ignition ends, of different colours, although each in becoming unignited acquires returning electric matter, from which it would appear the electric matter is different for each; still the difference may be owing to the bodies being dissimilar in texture; for that which the charcoal acquires is not black nor what the iron acquires brown. The substance of all bodies being homogeneous, while productive of different perceptions of colour, depends on the visual continuity at their surfaces, which depends on their electric atmospheres. The charcoal or tinder of bleached linen is made in the like manner as that of wood, by the process of de-electrisation by fire in the absence of oxygen. Charred linen in sufficient quantity may be ignited in fire where it acquires oxygen; on becoming unignited out of the fire it acquires that which makes us think it black. On making it in a smothered state it seems to be black; and the whole it consists in is so much of the elementary matter of the original linen. Hence what it acquires that makes the change from red to black may be considered the like of the elementary matter left during the smothered charring, and the same which makes the tinder in both cases seem to be black; consequently this black making or black sense-exciting element must have been abundant in the linen although the perception by the linen is that of intense white.

Ignition is a stage towards vitrifying, vitrifying towards transparency. Then as all bodies affect the visual pressure on the sense in consequence of intercepting the visual continuity, so those which are transparent affect it least: and as with glass before the face the sensible visual effect is nearly the same when there is no glass present, because of the vi-al medium being continuous directly through the ass, so from the same medium being imperfectly ntinuous through an ignited body, or continuous t some degrees beneath its surface, the visual pres-re promotes the sensation of colour or redness; and cause the ignited body, from its state of deficiency, quires electric matter rapidly from the hand, the rception is that of heat.

COMBUSTION.

MBUSTION is decomposition and dissolution of a dy and the dispersion of its elements in the medium fire. It is the igniting process continued to the treme on bodies of easy decomposition. As the ments of a combustible body become forced out me become re-united differently and acquire oxygen m the air, some are preciptitated.

Lavoisier defined combustion the uniting of oxygen th the combustible when sufficiently heated, by ich both heat and light are set free: nothing of ich is true excepting that oxygen is necessary to promote combustion. Heating a body to make it acquire oxyen is like covering one with paste that sand may adhere to its surface: neither does combustion always follow oxidating even were the body ignited: light and heat being set free is wholly imaginary.

A piece of wood thrown into the fire is surrounded with the minus-pressure medium of fire: it becomes de-electrised by the medium of pressure it contains which is under the force of the general pressure: it acquires oxygen in the vacated interstices and is then what is termed ignited: as de-electrising proceeds it acquires more and more of the medium of pressure or expansion, which keeps forcing its atoms and elements into the medium of fire until the entire of the constituents of the wood are displaced. Of the displaced matter the grosser element is precipitated, the rarer elements are forced upwards, some of which from differently intermixing become gas, some smoke and soot, while others, the most highly rare, acquire the oxi-electric element from the surrounding air and constitute flame. The whole are new formations from neither ashes, gas, soot nor flame being a constituent of wood, and each is indebted more or less to the air for elementary matter during its formation. As combustion proceeds re-formation is promoted with all elementary matter evolved. Even in charring, and although charcoal may be considered a residuum of unevolved matter, the coal is a new body, it is not wood. Could simple water, by galvanic agency, be deprived of some of its elements such as those belonging to flame, the remaining water, were it considered saline or acid, would be a new formation; as are all substances not included in bodies themselves and obtainable from them only after their decomposition, such as potassium and sodium, neither of which is in the vegetable body or its lixivium, nor even in potasa or soda. Potassium, sodium, charcoal and flame are new formations equally as crystals from the aqueous solution.

Combustion by friction is promoted similarly to combustion by fire. By friction electric matter is rubbed away and its further centrifugal egress from the wood promoted by the interstices made empty for oxygen and the expanding medium to enter, the force of the latter sets free ultimately the entire of the elements of the wood. As previous de-electrisation is necessary to admit oxygen and as the atmosphere contributes electric matter that excludes oxygen and the medium of space, in this wise provision of Nature spontaneous combustion and general conflagration are guarded against. It is not summer heat which sets whole forests on fire, but the state of the air in promoting desiccation and de-electrisation.

Combustion by solar agency depends on the same common principles. De-electrising is the commencement of the process, which, by solar agency is promoted in consequence of the Sun being a minus-pressure means. Solar matter or rays causing combustion has many objections. Adding matter, in the first instance, to the body, is contrary to the general procedure: adding a minus-pressure medium, it becomes questionable what sends this medium or matter from the Sun to the Earth; wherein consists the impelling cause; what impels the cause and wherein can end the number of impelling causes. Then, when solar matter is at the minimum of force or having no momentum, how is it to pass through a double convex lens and prefer the thickest to the thinest parts through which to pass. That there is solar matter is probably deducible from the office of Comets, which may possibly consist in collecting all already terrestrially used solar matter, which has become redundant in space, and returning it to the Sun as the heart of the system for renewed circulation: but that matter from the Sun proceeds in rays or pencils of rays capable of forcing its way through thick pelucid bodies and burning bodies is not maintainable on any natural asis. The Sun is a minus-pressure means, and at he focal point of the lens a body is under reduced ressure equal to the whole of the reduced pressure n the surface of the solar side of the lens. The Sun eing a minus-pressure means, a body in the focus f the lens becomes de-electrised, expanded and de- omposed, or exploded as gunpowder by the suddenly ushing in of the medium of space, not by solar mat- er or solar heat. A culinary fire becomes extin- uished by the Sun, which most probably arises from he minus-pressure it is under promoting combustion such a manner as permits the formation of the shy covering accumulated on the coals which ex- ludes all access of the oxygen element. The Sun nd Fire promote oxidation, which implies, that, in oth cases the body suffers loss in the first instance r oxygen to enter, or why is not the same body qually oxided without fire in the open air in the ade. On the fire quicksilver becomes oxided more nd more and may be de-oxided by the fire: at first it ecomes de-electrised by the medium of space forcing ut its free electric matter, to which oxygen succeeds, hich latter is afterwards thrown out on the de-elec- ising process being continued so as to permit excess entering of the expanding medium. It similar with water. Water as it is being de-electrised acquires oxygen up to the boiling point, which is then thrown out by the expanding medium and becomes a constituent of the steam.

Animal combustion forms no exception to the general procedure. The living body of great ardent spirit drinkers is subject to this species of decomposition. Ardent spirits in the mouth or on the hand do not excite heat but on the bare arm cold during evaporation, which arises from the liquid imparting electric matter to the limb as does water said to be cold. When in the stomach, ardent spirits part with the like matter to the stomach and its contents, the loss of which is supplied from the nerves to their great injury and thereby, with other effects on the brain, promote the sensation of heat which fire excites similarly. The stomach, from being repeatedly supplied with these de-electrising liquids, becomes so de-electrised as causes it to de-electrise other organs until the whole become charred and cindered: the minor elements of the flesh and bones escape and surround the body, which, as being minus-pressure means, promote the sensation of luminousness in the minds of spectators from which it is said the drinker is enveloped with a lambent flame.

Combustion by lightning is not from descending fire, but rather in consequence of the air being de-electrised, according to electricians, by the Earth. Any great internal change in the globe may cause a descending current of elementary matter and leave the vacated part instantly filled with oxygen, by which the optic pressure is such as promotes the sensation of red. Bodies involved in this descending stream, or adjoining it in its course, become de-electrised and charred, and by the medium of space, acquired within them at the instant, expanded, spilt or fused. As ignited charcoal rapidly whirled through the air causes the mental effect to be conceived an external circle of red, so may the rapid flow of minor elementary matter to the Earth and the transitory state of the atmosphere in the rear of the flow make the visual perception be imagined a stream of ignited liquid matter falling to the Earth.

FLAME.

FLAME consists of the most highly rare elements of a combustible body together with the oxi-electric element of the atmosphere, which together exclude the medium of space.

Wood and coal, in a retort surrounded with fire, become de-electrised and have their electric matter forced out in the state of clouded air or gas, some of which are not constituents of flame and prevent all access of oxygen. To get rid of these latter the gas has to be further de-electrised, which is effected by the application of flame, the instant of which the oxygen element enters and excludes all redundant elementary matter, at the same instant the pressure from without collapses audibly the remaining elements and flame is formed.

Flame can in nowise be considered a simple body or element the oxygen element being one of its constituents. Newton looked upon flame to be red hot gas, but were this the fact, the same gas, like iron, would admit of being ignited frequently and used repeatedly. When flame is inserted in a vessel of hydrogen it becomes extinguished, and may be said to become gas or smoke from having acquired elementary matter not a constituent of flame, and the hydrogen is not exploded from there being no oxygen atoms to make interstices for the medium of force in excess.

When to the smoke of a suddenly blown out candle flame is applied, the recognised effect is such as makes it be conceived that something, or some of the applied flame, has suddenly and heavily fallen into the smoke and that where the descent ends the fallen flame is deposited. But this is not the fact; the applied flame remains unaltered in shape and volume, its substance is not of a descending nature neither has any thing sensibly illuminating passed from it. To account for the phenomenon it may be said, that, as water is made cloudy when into it electric matter is discharged, the smoke is a gas or flame impured and clouded by electric matter. The applied flame de-electrises the column of smoke first at top, oxygen immediately enters and the de-electrised portion becomes suddenly and silently collapsed; it is now so much fire to the next portion of smoke which becomes converted to flame or fire to the next, and this rapidly, almost instantaneously taking place down the column to the wick where the supply of gas is in constant flow, it is imagined flame has dropt out of one candle flame to the wick of another. The mental effect is greatly similar to what goes by the appellation a falling star; but as there is no star deposited where the course terminates, the phenomenon may probably consist in electric matter being extricated in a stream the rear of which, from permitting entrance to the oxygen element, may be productive of the luminous mental effect and only at what may be considered the immediate end of the stream. The phenomenon being produced greatly beyond the atmosphere, may in some measure account for the visual effect being as a descending speck of light.

A candle during its combustion comprises a series of operations, which, for simplicity and utility bids defiance to the whole of imitative art to equal; yet from the indifference to what is familiar, the little symmetry required and genius concerned in the formation of a candle, there is nothing less noticed, understood and admired than the operations whence such general benefit is derived.

The entire materials of a candle are included in the small, compact, portable cylinder of tallow which surrounds an equal length of wick, the whole of which are not only the machinery but the raw material out of which, by a truly self-acting process consisting in different successive operations, a tissue of exquisite finish is produced. The various processes of de-electrising, liquifying and gas making are silently and regularly performed without friction and the encumbrance of containing vessels. The wick immersed in the fluid tallow answers as service pipes for conveying the crude materials into the refining fire there to be made gaseous, there retained as in a gasometer of supply and out of which as required it is gradually pressed to obtain as it were gradually the finishing polish. It is then a perfectly new formation, curiously situated over the remaining unfinished materials as the fire which is to convert them in like manner to the same improved state and where only the flame could be of general service. Nor does the gradual decrease derange either the mechanism or system of operation the whole being simultaneously reduced and performed, the remaining parts still retaining their original relative positions. The "many coloured" production is expanded at its base by the medium of space involved in the included gas, and compressed above from containing none of that medium. Thus by material sensible agency, promoted by the general pressure, the whole series of operations are effected, leaving almost nothing redundant, and for purposes not only greatly essential but in a manner general.

The grosser elements of the gas within the flame subsiding to the base, make the mental effect less luminous and what is recognised as blue; they fall from the flame and when collected are carbonic acid gas from becoming possessed, in the nascent state of the gas, or while they are passing through the air, of some portion of the oxygen element peculiarly combined. The electric elements of flame in constant issue from the apex become lampblack by acquiring from the air elementary matter such as ignited charcoal acquires in becoming unignited.

When flame, even of the purest kind, is applied to a sated body, that is, to one possessed of its natural quantity of electric matter, much lampblack is formed, but little or none if the body be deficient or ignited. Ice affords abundance of this kind of lampblack matter, as may be proved by applying flame to the bottom of a Florence flask containing ice. For delicate miniature painting the lampblack so formed may possibly be preferable, at least from being perfectly free from grit. Extinguishing flame by blowing strongly against it, is the consequence of separating it from the gaseous source of supply, within the wick.

Flame and the medium immediately round about it de-electrise bodies, render them deficient and their deficiency is supplied from the adjoining air. Inflammable gas requires to be de-electrised for the admission of oxygen and formation of flame, and mixed gases are not detonated unless de-electrised by flame or fire. On these principles depend the safety of the miner's lamp, not on the "cooling agency of the wire gauze." It has been stated that small metallic rings deteriorate and extinguish flame by contributing to it, in their sated state, electric matter which brings it back to gas. The wire gauze of the lamp being some distance from the included flame is not de-electrised immediately by the flame but by the air surrounding the flame; this air supplies its loss from the wires and these from the external inflammable air. This procedure being slow the air external of the lamp is not sufficiently de-electrised by the flame within the lamp so as to receive oxygen and the excess of the expanding medium, the latter of which is the immediately detonating or exploding cause, hence there is no explosion. Under these circumstances the flame is harmless in the midst of the most explosive air. It is surprising that cold should be considered an agent in promoting physical change, yet the inventor of the lamp strenuously insisted on its influence and that nothing but the "cooling agency of the wire gauze" is the preventive against explosion.

Perhaps a candle might be manufactured the flame of which would be sufficiently impure to be incapable of promoting de-electrisation of the inflammable air in Mines and answer the workmen's purpose equally well as the dim "light" by the safety lamp. A brimstone match while burning "blue," will scarcely de-electrise even paper so as to produce flame from the paper, and when "white" flame does appear it is from the charred wood of the match. Due precaution should be observed in selecting the *entire* of the materials in the composition of the miner's candle. Pitch, tar, rosin and brimstone, or a mixture of all with pulverised chalk to retard combustion, and a few small threads of old tarred rope running longitudinally *through the whole* might be productive of a safety flame, half flame half smoke, the latter excluding all excess of oxygen from the former. Which should be tested by passing a gentle current of wind from a bellows over the flame, and then should the white light sensation be unattainable its safety might be considered proved. In a small way, but in the absence of wind, trial could be made in oxygen and hydrogen or oxygen and carburetted hydrogen gases in a receiver, and were detonation and inflammation impracticable, would, so far, establish the fact. Coarse iron wire lanterns for the candles, by lessening the supply of oxygen, mitigating the effects of currents of air and retaining much longer the smoke round the flame, would afford additional security against casualities. The better way of effecting the disposition of the different wicks in the same candle is, to mould the candle in a cylinder, from the top or open end of which the threads should hang apart and so as that none touch the sides; and the fluid should be poured in so as not to bring the threads together.

FLUIDITY.

A piece of lead in a ladle on the fire becomes deprived of its electric matter and acquires the expanding medium : this loss and gain continuing the metal not only loses matter necessary to solidity but acquires the medium of expansion in excess : it becomes less and less solid and falls into the state of fluidity. The solid structure is undermined and the remaining elements of the lead become dispersed through the expanding medium in which they may be said to swim as globules of blood in the serum. The medium of space or expansion is now part of the fluid lead, in which the lead is as ice dissolved in water. From this view of the subject it is manifest the fluid is not the identical former body : it is the de-electrised metal in its solution, the medium of space being, as it were, the solvent.

Fludity depends on due proportions of several different elements with an excess, beyond what the solid state requires, of the medium of space, and the whole mutually intermixed.

As farina added to water impairs, and when in excess destroys the fluidity of the water, so, too much elementary matter at the expense of the medium of space converts a fluid metal to the state of solidity. Lead or any other metal, while being converted to the fluid state, is first deprived by fire of all excess of free electric matter and at the same time receives of the medium of space an excess; so, to restore the solid state the metal, when brought into the air, acquires electric matter which deprives it of all excess of the expanding medium and, as it were, thickens and solidifies the fluid; external pressure completes the solidifying process.

A refractory solid consists of an excess of elementary matter not removable by means of fire, therefore is deficient of other matter so that the whole should be convertible to the fluid state. To get rid of the excess being impracticable the deficiency is supplied by fluxes. While on the fire the body is by the fire de-electrised; it then de-electrises the flux the elements of which it acquires and then acquires the expanding medium, by which the solid becomes less solid and ultimately fluid, as is the case with biscuit to which water is added. Perhaps many bodies considered infusible would be fused by recourse to fluxes. It is probable that infusible bodies are made more solid by fire in the absence of a flux. The erroneous idea that fusion is caused by heat has been productive of many abortive trials. All fusion by flame and ignited gases applied by means of the blow pipe, is effected through the peculiarity of the promoting minus-pressure media, which consist in the decomposed gases the interstices of which are recipients for the thrown out atoms of the body.

There is no such thing as hot fusion : colour is as much the cause as heat ; but all fusion, at least by means of art, excepting of ice, promotes the sensation of heat, because all bodies, but ice, in being rendered deficient by fire of electric matter, cause the hand to suffer loss of the like to restore in them the equilibrium of quantity and the loss from the hand is productive of the sensation. Whereas ice consists of a very great excess of the same kind of matter, the reduction of a small quantity of which by fire destroys immediately the solidity of the superficial stratum of the ice, and ice-water by imparting some of this elementary matter to the hand is productive in the mind of the sensation of cold. In the sensations only, which are nothing hot or cold, is there any heat and cold, fusion is independent of both.

If it be true that a sword-blade has been melted in its scabbard without even scorching the lining of the sheath, then in Nature there are means of de-electrising bodies unknown to art, whereby some other elementary matter of the solid is displaced than the kind removed by fire, and which other bodies do not contribute or the lining of the scabbard would have been injured by its loss : but then, it may be said, if the body or melted blade could not supply its loss from any thing it should remain permanently fluid. If melted lead fell from the roof of the Eddistone Light House into the keeper's stomach through his mouth without the sensation of heat being strongly excited, the sword account may not be fabulous and each is an instance of fusion without even fire. There is, however, in that of lead a most miraculous escape from a broken jaw and perforated stomach by the great momentum of the ponderous metal, a circumstance of which the narrators of the tale have taken no notice.

Bodies are rendered fluid by passing over or through them a current of electric matter from the machine or the battery ; they are frequently oxided by a stream of similar matter ; from which on general principles it is inferable, de-electrisation has been effected when fluidity results and the element of oxygen is deposited. Sometimes the current de-oxides. In this case the oxi-electric matter of the body may be forced into the current and pass off with it ; and it may be that the body is de-electrised by the machine when it is imagined to be charged, as is frequently the case.

A solidifying fluid becomes solid as it recovers its free electric matter which displaces all excess of the medium of space: as it acquires the former it becomes thickened as water by flour; as it loses the latter it becomes contracted by external pressure.

A fluid is defined by Newton, a body, the smallest portion of which is put into motion by the slightest force: which is but the mere expression of the physical fact: That mobility is a distinguishable feature of fluidity is true, but of airs equally. According to this general definition both are equally fluids. Grains of sand are more easily moved than the parts of some viscous fluids, yet sand is not a fluid. Occasioning circumstances should have been included in the definition. Fluidity is the intermediate state between the solid and aeriform, and depends principally on the quantity of the medium of space in which the atoms of the body are involved. When the quantity of the medium of space in a body is at the minimum, external pressure is the greater and solidity the result; when at the maximum the intermediate or fluid state is destroyed and the aeriform produced. A fluid is elementary matter intermixed with such a proportion of the medium of space as leaves internal a fraction less than external pressure. As with solids external pressure is much the greater and with airs internal is equal to external pressure, so in fluids external over internal pressure is of that slight degree which permits mobility of the elementary atoms, in consequence also of the medium of space between them preventing their remaining in immediate contact.

SOLIDITY.

In the present state of the globe some bodies are formed without having passed through the semi-solid state such as metallic ores, earths and aerolites, according to the manner their elements happen to meet within the bowels of the earth, in the air and in aqueous media. The largest and most dense bodies have most probably been formed out of the elements of fluids.

All bodies, including that of the Earth itself, being resolvable into unalterable atoms, these, it is conceivable, formed the matter primevally created. Nothing beside atomic substance can be considered a created thing or other than a subsequent formation. Even the substance of the human body existed before man was on the Earth; "out of the ground he was taken," to it his mortal part returns, and eventually to elementary matter his body becomes resolved for the purpose of contributing to the formation of other bodies. That cannot be considered a created body the substance of which previously existed. Some interpret the word Adam, red earth: "dust we are and to dust we must return." Nothing can be more philosophic although figurative, than the expression, "all flesh is grass," its elementary matter being nothing different from that of grass which is a production of the Earth.

At first God created the whole of matter; out of which it may be conceived there was an immense volume, somehow collected together, of the different elements in a state of intermixture, without confusion, the formative state being that of order; and that by compression the greater part of this portion was converted into a sphere of water, leaving a residuum subject to increase by emanations to form a complete atmosphere. Then, in consequence of one side of the newly formed planet facing the Sun, some great transfer of elementary matter may have taken place from north to south or east to west within the planet, and from the oxygen of the water at the centre being useless, its absence would leave an immense nucleus of ice and cause other solids to be formed. Interchange of elements from one extreme to the other of the globe continuing, would leave the remaining water in the state the ocean now exists, saline, from having an excess or deficiency of elements requisite to constitute fresh water, and, as elementary transfer took place, deposits at one extreme and formations of a different kind at the opposite would also take place, and thus complete a superficial covering, of various kinds of solids, to the great nucleus the occasionally melting of the surface of which in conjunction with ferruginous substances, may have originated volcanos from which there is no region of the earth free and may still be the means of their intermittent eruptions. Of the most massy dense solids having been previously formed out of the fluid state appears certain, from the frequent discovery within them of organic remains. To the pressure of the medium of space only can all change from the elementary to the planetary state be referred.

The peculiar solid named coal, is by some said to be formed of decayed vegetable matter, by others the production of internal fire. Because, in the first instance, some few pieces of charred wood and leaves of plants are frequently met with in beds of coal; but which is mistaking an exception for the rule. Why may not coal be formed out of an aqueous mixture as well as solid crystals, and as gold, after the metal has disappeared, from the menstruum in which it had been dissolved. A cork is charred when surrounded with ice water, and were an aqueous mixture so galvanised, that is, deprived of some of its elementary matter, as wood by fire, and a precipitate such as coal the consequence, wood and leaves involved in the mixture would be in a degree also charred, and these, as precipitation took place, would be included in the still humid precipitation. The colour made sensible by coal indicates, that the charring process has been concerned and the charred wood is proof the mixture, or what the coal has been formed from, has undergone the like process. The different strata of coal indicate distinct precipitations; the shining glassy fracture and total absence of ashes and all cindery appearance, that fire is not concerned, or if so but very remotely. Nothing but precipitated matter could envelope a full grown toad and become a perfect mould of its body out of which there is no escape for the animal and into the massy block it could not possibly have entered. Similar is the case with a bed of chalk and flint. A stratum of flint is frequently found lying midway between the top and bottom of a bed of chalk. Every nodule of the flint is closely encompassed with chalk as if the latter had been a matrix to the former: the chalk is a perfect cast of the flint, which implies the plastic state if not former fluidity of the chalk. These appearances are manifest indications of the two kinds of body having been simultaneously formed out of the elements of an aqueous mixture, promoted by the general cause and remote circumstances or effects taking place elsewhere, by which the mixture acquired or parted with elementary matter which caused some of the whole to be compressed together making flint and the remainder cohered as chalk; were they the result of successive operations the flint or chalk would be forced to the bottom.

The previous humid state, of bodies the most dense, is strongly evinced in the basaltic columns of which the giant's causeway consists. In which are exhibited vertical columns of the densest texture regularly sided, each column consisting of many separate parts resting on and fitted to each other as if by art, the anterior convexity of one answering precisely to the posterior concavity of the other adjoining part. The several superficial planes are what might possibly result from external pressure on a mass of mud-like matter oozed upwards by internal force from the earth the column not being perfectly circular, not equally yielding or the pressure unequal, as is the case with the circular section of the stem of a succulent plant, particularly the balsam, which, as it loses its humidity becomes squared or many-sided. The mud-like column in its ascent from the ground may be considered in a state similar to leavened dough. Dough is leavened by the electric matter of yeast, which the expanding medium displaces in the oven and leaves the mass in the state of leavened bread. The leaven, of a column in the semi-solid state, being forced upwards, and accumulating from being unable to escape upwards, may be pressed into a miniscus-shaped stratum of elementary matter, forming a separating stratum which by dividing the column permits the electric matter of the stratum escaping laterally. The interposed stratum not only causes the division of the column but promotes the convexity and concavity of the adjoining surfaces. The whole taking place simultaneously leaves the column solidified, sided and, as it were, broken into several pieces.

The foregoing idea admits of being extended to the formation of bodies composed of *laminæ* such as crystals and mica-slate even the diamond, between each of which most probably lies a stratum of electric matter. Beds of granite lying in strata have every appearance of being ancient precipitations from aqueous mixtures: but the cause of their present inclination must be referred to unknown circumstances during their antediluvian formation. Lesser bodies shew evident signs of their former humid state in their various composition, fossil inclosures and incrustations. Aerolites may be considered solid bodies formed in the atmosphere instantaneously. For the stages of formation we should look to the primitive state of matter which was the elementary and the more general formative states into which matter enters: which appear to be from the elementary to the aeriform, next the aqueous productive of the semi-solid, which becomes in time wholly solid and the solid at once from the aqueous as gold from its aqueous solution. It cannot be imagined rocks and mountains nor even the body of a planet, were formed solid at once out of the aeriform state of matter, but rather that the matter of each had been in an intermediate state between the elementary and solid, which, of all others is the most conducive to formations. As metals and earths are formed during the combustion of vegetable bodies the constituents of which have been derived ultimately from air, so, all terrestrial bodies may be considered as subsidings from the original aqueous sphere into which the elements became primevally resolved. After this manner of planetary formation, it is more easy to conceive the formation than dissolution of a planet, and, without any good reason for the contrary, that new planets may be occasionally formed. On the whole, the Neptunean Theory seems the most natural as being more conformable with phenomena in general, particularly those on the largest scale.

WATER.

THERE is every reason for considering that water consists of some portion of all the elements of matter.

Five centuries before the Christian era it was said by Anetimines, water is the parent of all things; meaning, there is no kind of body but what derives its elements from water; or, that water in its composition includes elements similar to those of every other kind of body in Nature: which, upon strict investigation, will be found difficult to contradict, there being nothing to form bodies from but the common elements constituting the atmosphere to which the whole are again resolvable; and from atmospheric air being convertible to water, the latter, it may be justly inferred, includes elementary matter of every kind.

Water is formed naturally in a variety of ways; by art only from uniting oxygen and hydrogen gases. In the formation of steam from and its reduction to water, there is indisputable evidence contradictory of the established opinion, that, of oxygen and hydrogen only is water composed and into these only is it capable of being resolved.

Steam is not water: it is neither oxygen nor hydrogen gas, nor is it a mixture of both or it would be subject to detonation. Steam is less than water by the elementary matter the water, in being made to boil, loses in the direction of the fire; and it contains the medium of space in quantity much greater than the water whence its elements were forced. Water on the fire becomes de-electrised and acquires the expanding medium; as it approaches the boiling point the complement of the sufficiently de-electrised portion is thrown over by the expanding medium, and the whole of the evolved elements together with the expanding medium constitute steam. The pressure of the expanding medium constitutes the force of steam, not heat. Steam is a perfectly transparent air as it issues from the spout of a tea-kettle and permanently such in an ignited cylinder. Some distance from the spout it becomes cloudy in consequence of the elementary matter it acquires from the air, the like of which an ignited cylinder has not to contribute. Steam is converted to water, not from being condensed by cold, but from acquiring elementary matter similar to that of which when in the boiler whence it issued the water was deprived by the fire. This matter steam acquires while passing through unignited tubes and becomes aqueous. To prevent access of this matter, not retain heat, the cylinder of the steam engine is enclosed within a similar cylinder, between the two there is confined air which does not acquire electric matter from the outward cylinder as rapidly as it parts with it to the inner, hence air is said to be a non-conductor. And as the steam is nearly in a state of flow through the cylinder, what it does acquire is too trifling to lessen the force on the piston.

Water is formed without uniting oxygen and hydrogen gases, as when steam is let escape into the air. If steam be considered these gases in a state of mixture, it should become water on the application of flame, and in passing through an ignited tube should promote, not retard combustion; when forced into a culinary fire it lessens ignition and injures if not destroys flame.

Water is formed naturally on the surfaces of bodies and found streaming down walls and wainscots under cover during a certain state of the atmosphere. This is not water deposited on the walls nor precipitated from the air, neither is it humidity condensed by cold, but is water formed on the body: the body contributes its electric atmosphere and the atmosphere the complement in elementary matter, which together form the water; without the gases oxygen and hydrogen, hydrogen at least, being present; without detonation or other combining cause than atmospheric pressure. What is said of water held in solution in the air and becoming precipitated is a mistaken notion: to be so it could not be aqueous but aeriform: as well might coal after its combustion be considered in solution in the air. If the walls be previously de-electrised by fire there is no water formed on them; were water in the air the walls could not prevent it falling on them and its evaporation would be sensibly known.

Water is formed by the meeting of certain winds, from each contributing elementary matter necessary to constitute the aqueous state of matter. Neither of the winds contains rain, which could not have remained above unsupported; neither of them is oxygen or hydrogen, there is no detonation, nor is it likely such gases could exist at the same height in the atmosphere. It cannot be maintained a cloud previously contained, unsupported, the vast quantity of water that proceeds from it and but gradually; nor, that, of two meeting clouds one is oxygen the other hydrogen gas, much less that their intermixture is not dependent solely on the general pressure.

Water is formed of misty days on our clothes unequally; those which involve in their rough surfaces most electric matter, such as woollens, furs and beaver hats have most water formed on them. It is formed on the spider's web as on furs without *the gases* or detonation; and copiously on the sides of mountains enveloped in clouded electric matter, the exhalement of which lessens the formation of water. It is not water that exhales into the air but its elements in an aeriform state, which, if not subject to re-formation water must become extinct: still it cannot be in the air but in a falling state.

Water is formed unequally on different bodies under equal circumstances in every respect but that some contribute to the air more electric matter than others; when, had it rained, they would have been wetted equally; some of the number may at the same time have no water formed on them; each according to the quantity of electric matter it contributes is more or less wet. A metallic or glass vessel containing water just drawn from a well and however closely covered, is quickly bedewed on the outside even in the torrid zone, where the air cannot be considered so much as humid, owing to the water giving out electric matter through the sides of the vessel to the air, which together become water. When the water in the vessel ceases to give out electric matter no more water is formed on the surface and the surface gradually becomes dry. Were the water a precipitation from the air, adjoining bodies also would be wetted at the same time: and the water exuding through the sides of the covered vessel, is refuted by the cessation of external water even while the vessel remains almost full. Furs, wool and hair retain much electric matter; metals little or none: the contents of the former prevent the passing through them of the electric matter; hence arises the idea they communicate heat to the body as well as of their being of a non-conducting nature: in being retainers of electric matter which enters into the composition of water consists their fitness for hygrometric purposes, and the unfitness of metals for the like in these being non-retainers: still the hygrometer evinces nothing of water in the air; it shows the state of the air, whether at the time it contribute of its elements much or little to the electric matter connected with the hair of the instrument.

In Nature water is formed as dew. Were dew condensed air or exhalation and precipitated from the atmosphere, all things beneath it should be covered with dew; whereas on the same ground and at the same time different bodies are differently bedewed, some not at all. The leaves of plants have, some much dew others none at the same time; some have much others none on the upper surface; those with none at top may have much on the under surface where dew could not fall. Were dew an exhalation all nethermost surfaces of leaves of the same plant should be equally covered with it: the fact however is some are perfectly dry while others have it on them in large drops. The phenomenon cannot be accounted for consistently by either condensed air or exhalations and only by water being formed on the sides of the leaves possessed of much electric matter which goes towards the formation of the dew.

The proposition of difficult solution hitherto, admits of easy solution on the foregoing principles; why the same plate of glass, coated at one side with tin foil, has much or no dew on it, under equal circumstances, according to the side which is uppermost; or, why two plates of glass, one side of each coated with foil, should collect dew unequally, the only difference being that the naked side of one and coated of the other is uppermost at the same time: in which case the glass surface is covered with much dew while the metallic coating of the other remains comparatively dry. The coated side, when next the ground, acquires much electric matter from the earth which it does not retain but parts with to the glass by which it is retained; to this the air contributes the complement of the elements of water, and of these dew is formed. When, on the other hand, the glass side is next the ground, the electric matter it acquires is passed into the conducting foil, which from not being retained by the coating passes off into the air, so from there being nothing of electric matter on the foil for the air to contribute elementary matter to, there is no dew formed on the uppermost or coated side.

Water is frequently discovered in experimental operations most unexpectedly *the two gases* not being present, sometimes neither. Sir Humphry Davy, that most acute experimenter, found "water suddenly appear when there was nothing present to which it could be attributed if not to nitrogen, which disappeared simultaneously with the water appearing." The difficulty is surmounted at once by allowing nitrogen, which is but elementary matter, like all other, of no essential property, to be a constituent of water; to it the other elements of water became insensibly added during the experiment, water was formed and the nitrogen air of course ceased to be present.

The humidity of the interior of the animal frame is doubtless formed similarly, to which may be added, much of the aqueous fluids constituting hydrocephalus, dropsies generally, milk, the liquor pericardium, water of blisters and humidity of the lungs. In respiring on a body, sated superficially with electric matter, water is formed, not deposited, but not on an unsated body or one rendered deficient by fire. As well might the synovia be considered the food of the stomach secreted and deposited as the different liquids and moisture of the body: the aliment in the stomach and air in the lungs supply, in part, elements towards the formation of the whole, of which the blood is perhaps the principal carrier. The stomach and its contents are as the galvanic trough and solution whence also the different organs of body acquire uncombined circulating electric matter that promotes humidity and minus-pressure effects. All succulent fruits, some of which are raised on the most arid soils, the water melon, cucumber and orange have their water formed similarly, not by due proportions of the two gases oxygen and hydrogen nor by capillary ascent from the earth of highly flavoured juices.

It is not because some liquids are said to be sweet others bitter, some acid others alkaline, that the whole are not water. All aqueous fluids are but water plus or minus some of the elements of common water. Liquids considered as being possessed of the above qualities are water to which different elementary substances have been added or from which some have been abstracted. Deducting the element or elements which make water, formed by compressing atmospheric air, acid or alkaline and pure water remains. The solution in the galvanic trough is evidently water plus something and is rendered nearer to pure water as it gives out at the wires currents of elementary matter. On these principles, founded on the homogeneity of matter, all manner of bodies, solid, fluid and aeriform are convertible to water, were it practicable to add to each that of which it is deficient or deduct what it has in excess of the constituents of simple water.

Water is formed by the uniting of oxygen and hydrogen, because all the elements of water are included in these gases. Oxygen and hydrogen are the elements of water in two parcels, so when united necessarily form water. Each includes much of the medium of space or the volume of each could not be greater than that of the water whence they were obtained; this medium both gases lose on becoming again in the aqueous state. Supposing for an instant water is [illegible] posed of seven elements; that, by art one [illegible] is known of effecting its decomposition, and [illegible] result consists of two gases one including [illegible] other three elements; on re-uniting these [illegible] result and we imagine each gas is a single [illegible]. Still of the whole any six and one, five and two [illegible] and three would be productive of an equal [illegible] The nature of the constituents of water has [illegible] conceived from it being so positively [illegible] gen and hydrogen are simple elements. [illegible] the case why is flame applied to effect [illegible] to decompose one or both. As neither [illegible] is in water, and the water has less [illegible] constituents, evidently decomposition [illegible] union and the union is not of the [illegible] when dispossessed of the medium of [illegible] the gases are indebted for their [illegible]

The fame of the brilliant [illegible] pound nature, the formation [illegible] water, had considerable [illegible] of the original [illegible] *rationale* being correctly [illegible] that oxygen and hydrogen [illegible] water, and from these gases [illegible] of the product when water is [illegible] that of these gases, then considered simple elements, only, is water consituted; and that each is of a simple uncompounded nature was said to be proved by their being again obtainable from the same water. Still in this decomposing operation the French chymist found other substances in addition produced, and in the forming process, a residue of gas was discovered that appeared to be neither oxygen nor hydrogen, which he attributed to the impure nature of the bodies whence the original gases were obtained. It is also recorded that upon decomposing and recomposing the same water several times, the product and residue were still more varied and more differently complex in every instance: but as the quantity altogether of new formations was but small compared with the oxygen, hydrogen and water, and as the entire product equalled in weight that of the water decomposed, the foreign substances excited scarcely any attention, although from these apparent exceptions the rule is deducible. Stronger presumptive symptoms in confirmation subsequently presented of water consisting altogether in oxygen and hydrogen gases, upon it being ascertained the exact proportions of these airs in water and the necessity of uniting them gradually, by which all complexity of product is obviated. In the first trials, symptoms of acidity and alkalinity appeared, also muriatic and nitrous acid, together with nitrogen and carbonic acid gas. In the latter and present day experiments these anomalous productions are prevented. The *rationale* is, water consists of some portion of every element, and accordingly as these are separated from water and reunited to form water, the product is oxygen and hydrogen only in the former and water only in the latter case; but if the proceeding, in either instance, be informal or irregular, in addition to the general product new formations take place, and the elements of all such are constituents of oxygen and hydrogen, therefore of water.

The more complex nature of water than the Lavoiserean theory maintains is made evident by the experiments of Priestly. This indefatigable experimenter says, the whole of a given quantity of water is convertible into air similar to atmospheric but nearer to nitrogen; also, that the entire of a piece of ice may be converted to nitrogen gas. Modern discovery, by converting atmospheric air into water or some kind of aqueous fluid, verifies the whole of the foregoing and proves that the elements of nitrogen air are constituents of water. Similar to the air obtained by Priestly from water and ice, is that generated in the steam engine cylinder, generally imagined to be atmospheric air involved in the water of the boiler, a circumstance in nowise likely, particularly as the quantity is so great, and on the increase, as to require a distinct pump for its removal. Still there is neither nitrogen, hydrogen nor oxygen air or gas in water, but water includes elementary matter capable, by subdivision, of forming the whole and accordingly as the elements of water are set free is the gaseous product: which is undeniable proof also of the homogeneity of matter.

Water is convertible into ice as wood into charcoal which is not wood, neither is ice congealed water. Ice does not include all the elements of water, it is deficient of some which leaves it with an excess of others.

To the labours of Priestly we are indebted for the theory of congelation. Priestly says, that, "air purer than atmospheric is given out from water at the instant of congelation." And since his day by other experimenters, that the water at the negative galvanic wire—which is the side parting with hydrogen, its oxygen being evolved at the opposite—freezes first: from which it is inferable oxygen is a hinderance against congelation. Then as air "purer than atmospheric" is obviously oxygen, as congelation takes place soonest at the side minus oxygen, and as congelation is retarded by adding to water chymical acids all of which contain much oxygen, together with the well known circumstance of facilitating congelation by agitating the water as if to shake oxygen out, it is conclusive that the portion of water congealed, that is, converted to ice, consists of the elements of water less its oxygen, wholly or in part.

The theory of congelation may be this: the state of the atmosphere being favourable for the removal of oxygen the pressure of the medium of space within the water throws it out, collapses the de-oxided elements, and at the same time expands the remaining water.

Ice is not expanded during its being formed: as consisting principally of minor negative electric matter in excess it excludes the expanding medium, hence its atoms are under less internal than external pressure: it is the remaining water is expanded. As de-oxiding the water takes place the medium of space rushes in expands the water so as to elevate it in the vessel, and after having formed the ice recedes, leaving the surface of the water considerably beneath the ice. If the ice be expanded so as to press it against the sides of the vessel, the force must be much inferior to that by which the water is expanded; for it frequently happens the bottom, beneath the water, of an earthenware vessel, is blown out, not the sides on which the plate of ice is formed and remains firmly fixed: the fact is discoverable in any instance where the whole of the water is at once converted to ice. De-oxiding, collapsing the de-oxided elements and expanding the remaining water, include the whole of the congealing process. Cohering the complement of the de-oxided element and expanding the water are simultaneous and consequent on the de-oxidation which facilitates the entering of the expanding medium.

Ice contains electric matter in excess, and but little if any, of the oxi-electric element. When held to the fire it becomes de-electrised, not, however, throughout but at the surface continually is the excess reduced, and the remaining of the de-electrised portion of elements then become again in the aqueous state. Ice-water, or that immediately formed from ice, being deficient of oxygen and nearly sated with minor matter is at the minimum of density; it acquires density as it acquires oxygen, which removes it farther from congelation; in this state its electric matter excludes the medium of space and from being under greater external pressure it becomes contracted up towards 42° by the scale. As it acquires more oxygen more of its electric matter becomes displaced, the medium of space enters proportionally and it becomes expanded. When placed on the fire it becomes further de-electrised and oxided like other bodies so circumstanced, and acquires continually up to 212° the medium of space which expands it to the maximum in an open vessel. The maximum of density is not the maximum of oxidation, but that point where the water contains the minimum of the expanding medium. Quicksilver being more difficult of de-oxiding sufficiently continues fluid in water at the freezing point of water. When the thermometer is placed in water at 32° the quicksilver acquires electric matter from the water which displaces the medium of expansion from the quicksilver and contraction, by external pressure, lessens the elevation. This going on while the water remains uncongealed, the fluid in the tube becomes lowered some degrees below the freezing point of water. The same instant the water becomes congealed the thermometer rises and indicates 32°, the rise is erroneously considered the effect of heat given out by the water. The rise is produced by the quicksilver giving out to the water electric matter and acquiring the equal of the expanding medium: it is the equilibrium of electric matter taking place between the two fluids which promotes the rise. During the descent of the quicksilver the latter is acquiring electric matter from the water which displaces the expanding medium; upon ice being formed the remaining water is left somewhat deficient of this matter and supplies its deficiency from the quicksilver, the loss of which is supplied by the expanding medium the force of which effects the rise to 32°.

The change of fresh water to salt has been effected most probably, as already stated, by the primeval water having contributed some of its elements, one or more, towards the formation of the solid earthy part of the globe and from having in this state acquired the oxygen of the central water made solid ice in consequence of being de-oxided. Hence to convert salt into fresh water, the trial should consist in adding that to the salt water which would contribute elementary matter and become at the same time oxided by the water. Could any species of clay be found to effect these purposes, the desideratum would be obtained least expensively, subsequent filtration might or might not be requisite.

AIRS.

An air or gas is constituted of portions of certain of the general elements, involved in an excess of the medium of space beyond what is consistent with the state of fluidity.

Airs are obtained from a body as steam from water; by the body suffering de-electrisation whether in the medium of fire or any aqueous medium, and acquiring the expanding medium which forces their elementary matter out. This elementary matter together with the expanding medium constitute the newly formed air. No body contains as air or gas that which is obtained thuswise from it: as little is gaseous oxygen, hydrogen or steam in water as smoke in the substance of a candle or carbonic acid gas in carbonate of lime; the whole when obtained are equally new formations.

The atmosphere is said to consist of two gases, oxygen and hydrogen, but which is as erroneous as that a mixture of wine and water is two liquids. The atmosphere consists of the whole of the elements of matter remaining uncombined, therefore is capable of subdivision into every kind of gas or air. Any number of elements when mutually intermixed constitute a single gas or air. There may be as many gases in the same vessel as each maintains a different location, but mutual intermixture destroys the individuality of each. Oil, water and alcohol may exist distinctly in the same vessel as three fluids, but when intimately mixed the whole are but one fluid. The atmosphere is but a single air, as a sovereign is but one coin although containing gold equal in value to four crowns. It is neither oxygen nor nitrogen but a mixture of every gas. Forming atmospheric air by uniting oxygen and nitrogen is like re-forming water by uniting the gases into which water has been decomposed.

All gases are compounds, for each includes the medium of space. The atmosphere may have origin, as already noticed, from being the residue of all the elements after the planet was formed. Without some degree of atmosphere coeval with the sphere there could not be one now, the rise of exhalations depending on the buoyancy of a pre-existing atmosphere. Of all airs atmospheric is probably the most compound.

In consequence of a volume of atmospheric air having been divided into oxygen and nitrogen gases and because the like gases otherwise obtained when united form the same as atmospheric air, it has been handed down from the days of Scheele that the atmosphere consists of a mixture of these gases. But as these do not exist unmixed as carbonic acid and hydrogen gases in the same vessel, and as there are not to the earth two concentric atmospheres, it is not the philosophic fact that the atmosphere consists of two gases. The atmosphere is constituted of the elements necessary to form all manner of airs, solids and fluids; it is as the alphabet without a single word yet capable of subdivision and arrangement so as to compose the entire of a language. The like of its elements belong to all manner of bodies and the whole become atmospheric air as the bodies become decomposed.

While the origin of the atmosphere has remained unasked, how the air is maintained respirable during its continual deterioration has been frequently required. According to Priestly it is kept in a renovated state by oxygen given out from the waters of the earth and the vegetable kingdom. By such partial circumstances and casualties none of the great provisions of Nature are supplied. Elementary matter does not admit of deterioration: gases may be said to be deteriorated and rendered impure, but their elementary atoms are unalterable therefore incapable of being deteriorated. Oxygen gas is not consumed by combustion nor lost by respiration, it may, in both instances, be decomposed, its elements separated and afterwards re-combined otherwise so as to form airs unfit for combustion and respiration, but these cease to be such when decomposed and mixed in the great ocean of air. The fact is, that as matter is unalterable and nothing lost, oxygen exists after respiration and combustion equally as before, but after these operations the oxi-electric element becomes so differently combined as renders it inextricable for these purposes.

That oxygen air includes more or less of the elements of nitrogen, is proved by the experiments of the great Priestly. Already, on his authority, it has been shown, that nitrogen air is obtained from the decomposition of water and nothing else from the decomposition of ice; water is formed from compressing atmospheric air; therefore the elements of nitrogen are included not only in water but in one or other, if not both, oxygen and hydrogen which include the whole of the elements of water.

That nitrogen air is included in oxygen gas is made manifest in their mutual intermixture. Nitrogen and oxygen when united are but one air, atmospheric, and although of unequal specific densities they become mutually intermixed. If oxygen be inspired an equal in volume or weight of nitrogen is expired. Nitrogen air is indispensable to respiration or we should not have been surrounded with an ocean of such air. That which during respiration the blood acquires is not oxgen air; air cannot permeate the membrane of the lungs; it consists in a single electric element, the oxi-electric. Oxygen or atmospheric air being inspired and de-oxided by the blood nitrogen is expired. The lungs being impervious to air, and air in the blood destructive to vitality, it is conclusive the inspired air, whether atmospheric or oxygen, gives out to the blood a highly rare element, which is that to which nitrogen is indebted for being respirable. From which it may be inferred that atmospheric air is nitrogen including a certain portion of the oxi-electric element and oxygen is nitrogen saturated with this element. All airs being but atoms, all chymical and essential qualities fictitious, there can be no difference between airs or gases but what relates to the more or less of the general elements of differently sized atoms of which they are constituted.

The invaluable experiments of Priestly in proof, are these: he confined oxygen air and venal blood in the same bladder, the former became nitrogen the latter similar to arterial blood. He confined nitrogen with arterial blood in a bladder, the former became respirable the latter similar to venal blood. He surrounded a wet bladder containing venal blood with oxygen, the latter became deteriorated and similar to atmospheric air, the blood resembled arterial. He surrounded another wet bladder containing arterial blood with nitrogen which became respirable the blood lived. From which and breathing being de-oxiding oxygen, that nitrogen is included in oxygen remains indisputably true: and from oxygen being de-oxided, nitrogen oxided by blood in a bladder through which air cannot pass, it is equally certain that that which makes nitrogen respirable and converts it to oxygen is a highly rare element, and hence it is that blood is oxided in the lungs which are impervious to air and not increased in weight by what converts it from venal to arterial blood. By adding nitrogen to oxygen the oxi-electric element is in part deducted from the latter, added to or dispersed through the former and atmospheric air is the result, which when deprived of the oxi-electric element nothing remains but nitrogen. Then if the entire of what makes nitrogen atmospheric air be deducted from oxygen there remains also nothing but nitrogen. These, with Priestly's proof experiments, show the compound nature of oxygen and wherein consists its constituents.

On these principles may be explained the phenomenon of gaseous ammonia containing oxygen, but which is not obtainable by decomposition of the alkaline air, the product being but nitrogen and hydrogen, which, when re-united do not make gaseous ammonia. By tests it is discovered there is oxygen in the gas, yet its loss is not discoverable in the weight of the gases obtained after decomposition, therefore the oxygen is not oxygen gas but consists in the oxi-electric element of oxygen gas.

Gaseous ammonia is not formed by adding to nitrogen and hydrogen oxygen gas; Priestly says one or the other must be in the nascent state. By which it may be understood, that; only while one or other of the gases is forming is there opportunity, that is, interstices, for the oxygen element to enter; as if the atoms of the oxi-electric element, under such circumstances, made interstices for themselves such as do not exist between the atoms of formed nitrogen and hydrogen: that when oxygen and hydrogen are united the atoms of the latter enter the interstices of the former and displace from them the imponderable oxygen atoms but which in the nascent state retain their situation.

Symptoms of oxidation frequently present without oxygen gas being present and without the oxided substance acquiring weight. Priestly made known the oxidation of leaf gold in ice-water. Electric currents from the machine, battery and pile oxide similarly; also, beyond the red in the prismatic spectrum substances show signs of oxidation without increase of weight; which implies, that, in all such cases oxidation is effected by the oxi-electric element unconnected with the nitrogen that belongs to ponderable oxygen gas. To which may be added, that as unrespirable nitrogen gas is never found in Nature, and by art only obtained from the de-oxided air or by decomposing different bodies, it is inferable hence, that, the interstices of its atoms are so peculiarly and wisely adapted as recipients for the atoms of the respirable element that the nitrogen interstices cannot exist unoccupied by the atoms of the oxi-electric element. Animal matter is considered the most prolific source of nitrogen, although that which makes nitrogen oxygen gas is constantly received into the animal frame. But as the nitrogen of animal matter is part of the body itself, and as the oxygen element is, after a manner, in a state of flow into and transpiration from the body—which is implied by it being endlessly inspired—it has no means of combining with the nitrogen or grosser element of the animal organs. It is in fact a minus-pressure means for promoting that unequal pressure on the organs on which their functions depend: possibly by reason of it carrying off with it in its interstices other minus-pressure matter from the electric atmosphere of an organ and thereby leaving the organ under altered pressure, until its atmosphere becomes renewed, to be again displaced by the oxygen element of the sanguineous current while being impelled through the system. On this idea the rise of the diaphragm upon inspiration may be considered the consequence of the acquired oxygen element of the blood de-electrising the diaphragm, which becomes lifted by the medium of pressure in consequence of its minus-pressure matter having been carried away. The like suggestion applies to account for the stomach being inverted and its contents thrown upwards by means of de-electrising emetics. The electric matter carried off by the oxi-electric element and thrown out in respiration renders the expired air unfit for respiration. Oxygen air is neither expired nor transpired, because of its nitrogen not being acquired by the blood in the lungs during inspiration. A body that is increased in weight by being oxided, has acquired the nitrogen of oxygen gas together with the oxi-electric element, but the latter only when the weight is not increased.

Oxygen and hydrogen include the whole of the elements of water. There is no oxygen in hydrogen nor hydrogen in oxygen. The grosser or nitrogen element belongs to the oxygen. Hydrogen may be said to consist of the minor elements of the water and when de-electrised by fire and having acquired the oxi-electric element exist as flame. What is said of an acidifying principle has been imputed to both oxygen and hydrogen. It should however be held in mind there is nothing acid in Nature, matter is not acid and cannot make bodies be that which it neither is nor to which it can be converted. Acidity therefore is not a quality of either oxygen or hydrogen nor a physical agent, it is a sensation only. Of nitrogen it may be said, its negative nature, or, chymically speaking, negative properties, evince that it consists of mere atomic substance of inactive essence, which is the case with the atoms of every other gas and with those of the entire of matter. The azotic nature of nitrogen may consist in this kind of gas de-oxiding the blood in the lungs, which must ultimately cause the circulation to cease. The air in such case may not be oxygen which is expired, owing to the admixture of elementary matter given out at every expiration.

Carburetted hydrogen gas is obtained by de-electrising coal in the medium of fire; the gas becomes forced out by the medium of space much of which it acquires. From the volume of the gas and altered state of the coal it is manifest the gas is a new formation at the expense of the coal, and not previously included within the coal in the gaseous state. To convert this gas to flame it must be deprived of some of its elements, which is effected by flame; and that in so doing the gas is not heated is evident, from there being no flame even in the ignited retort while full of gas, nor in the gasometer were it also ignited. Were heat the producing cause of the gas there is no reason why flame should not flow from the retort and not gas. Were heat the cause of the enlarged volume it should escape, when the gas has remained in the gasometer, through the gasometer. Were heat the air-expanding cause, when oxygen and hydrogen gases are detonated there should be an immense quantity of heat set free, in consequence of their volume being reduced to nearly the two thousandth part of the entire volume; nothing of which being the case, only to the medium of space being a constituent of these, and every other gas, can the difference of volume between the gas and the body giving out elementary matter that becomes gas be attributed.

Carbonic acid gas, from its superior weight, may be considered as constituted principally of the grosser element; some minor elementary matter in its composition makes it different from nitrogen, and the manner the portion of the oxygen element is involved in the interstices of the whole makes it different from oxygen gas and from atmospheric air.

The carbon of the chymist is a nonentity in Nature. The term should be confined to the soots named lampblack and impalpable tinders, and is more applicable than that of charcoal. Charcoal of flame, of paper and linen contrasted with the charcoal of wood, shows at once the inconsistency in making charcoal a general appellation to not only every thing charred but several similar substances otherwise formed.

MOTION.

It has been said by no less authority than Dugald Stuart, "as there can be nothing more evident than that motion, however long continued, is the immediate and only effect produced on a body by impulsive force, even but momentarily applied, it would evince the greatest ignorance to dispute the proposition." But this most positively asserted proposition is not only deniable on rational grounds but refuted by admitted principles, and it will be found eventually the ignorance lies in being so indifferent to the simple fact, that of continued motion after impulse being effect greater than cause or effect without any cause.

It is a strange and most unphilosophic notion, that of the earth continuing in motion from the projectile force applied to or "once impressed on it" not less than six thousand years since, not since renewed, and capable of perpetuating it without further impulse, which is an effect that admits of no comparison with its cause, yet effect is necessarily equal to the cause.

It is also said that motion is indefinable from being a simple idea, whereas it is not an idea but an absolute physical effect, it is matter put into a moving state. The knowledge we have of motion is ideal, still the idea is not that which is in motion. The body in motion promotes the sensation of colour, and in consequence of the visual pressure, productive of the sensation, as it were passing over contiguous parts of the retina in succession, makes it be imagined the sensation, which is supposed to be the body itself, is in motion.

Motion is indefinable from being nothing separately existing, nothing distinct from the body which is in motion; it is but the changeable locality of the body while the body is not allowed to remain where it is. To him who had no sense-promoted knowledge of motion the description should include cause, patient and effect, somewhat thus: a body being forcibly struck is driven out of its resting place to some other at a distance and during the transfer from place to place it is in that peculiar unsettled state named motion.

According to Newton, a body is indifferent to its state whether at rest or in motion. This none can deny of brute inert matter, the contrary implies sensible inclination, nothing of which belongs to a mass of insensible atoms. Yet he maintains, a body endeavours, perseveres to keep itself in its present state of rest or of motion in consequence of its inertia, which enables it to resist being moved out of rest and to forcibly oppose being put out of motion. But what can inertia do: the mere term implies that something else promotes the resistance a body presents against being lifted from the ground and moved through the air; and from impulse being indispensable towards promoting motion it is obvious, that the force, in whatever it may consist, is what resists, not the body itself while in motion, which cannot be of itself an instant of time in motion. Newton had no idea that impulse must be as constantly continued as there is motion, which is no more than effect having its equal for cause. A body possesses no choice, is endowed with no endeavouring or persevering means in regard to its condition of rest or motion, it is the mere patient of circumstances foreign to itself. When it resists a lifting or stopping force it is made by a foreign cause to resist. The general pressure makes it resist that which opposes its motion. Inertia being an "innate force" is evidently a contradiction in terms. Perhaps no greater absurdity or blunder can be more tritely expressed than that of *vis inertiæ*, although Newtonian therefore universally adopted; it is, force in that which has no force.

It might be said, from repeated instances in both physical and moral philosophy, the ear being satisfied satisfies the understanding, or so many well rounded periods and trite sayings could not, most inconsiderately, be received as truths and truisms; such as, the atmosphere partakes of the motion of the earth; tendency of a body to remain at rest; perseverance to continue in motion, and, for ever and ever.

The atmosphere's motion with the earth has the same cause as that of descending motion. What tendency does a stone on the ground evince to remain at rest; take away this supposed tendency the stone remains without it equally at rest: rest is no effect, therefore requires no cause for its continuance, it is the result of a former effect. As a body is left there it must remain until disturbed by cause foreign to itself. Tendency to remain at rest implies not only resistance against being in motion but motion natural to bodies, but as motion depends on impulse it is not natural to matter, therefore the contrary or rest is the natural condition of matter and bodies, which dispenses wholly with this self-tendency by the innate force of inertia. There is as little self-perseverance or tendency possessed by a body to keep itself in motion as at rest. An inert mass of matter acting, evidently implies its acting is the effect of something in a state of force causing it to act. That which cannot of itself resist being put into motion, which cannot change its place of itself, nor keep changing its place but by foreign assistance, has no resisting means in itself against being put out of motion, which implies that the physical means acting on it the whole time it is in motion are that which causes the resistance not the body or its motion.

A projectile vertically impelled shows, by ceasing to ascend, and by returning to the ground, its want of tendency to continue in the state of motion. All resistance has been overcome by impulse or there could be no ascent, the body moves with a force the excess of impulse above all resistance, and resistance is less and less the whole of the ascent, yet the body ceases to ascend, comes to rest in the air for an instant and eventually becomes precipitated. It cannot be maintained the body possesses tendency to change its direction while in motion. Were bodies possessed of any such "persevering" property to keep in motion, all bodies once projected would remain indiscriminately in motion. Hence, self-tendency, endeavour and perseverance to remain at rest and continue in motion, are manifestly but assumed properties of bodies and misleading expressions which greatly serve to leave the true cause of all motion, the general pressure, more and more out of sight and to reconcile the anomaly of motion being greater than impulse, which is effect much greater than that by which it is effected and in the excess so much uncaused effect.

Another reason assigned for motion without impulse—all motion when impulse has ceased being motion without impulse—is, that as a body while in motion cannot put an end, of itself, to its motion, hence this is sufficient cause for it being, without constant impulse, in motion. In exemplification it is advanced, that, as the motion of a body on a plane is less retarded by sand than gravel and still less by the plane without sand, so were all friction by the plane got rid of and the plane interminable, the body would continue for ever in motion. What is there, it is asked, to stop it, it cannot stop itself and all impediments against its motion are away. The true question is what makes it go on: of itself it cannot proceed, therefore it must be moved by foreign aid to make it proceed and to the last instant of its motion as well as from the first, therefore throughout the whole it must be acted on impulsively. The absence and removal of lets and hinderances are no impelling cause. The absence of air in the torricellean tube is not cause for the quicksilver ascending; nor is the removal of disease the cause of vitality. A body pressed equally on all sides must be at rest, but the removal of all pressure does not put it into the contrary state. A man does not fall to the ground from a precipice because he cannot stop himself; during the fall there must be an impelling cause, which acts on him not only the entire of the descent but more and more continually to accelerate his motion. So, likewise, were there no constantly impelling cause the body could not possibly proceed along the plane; the removal of hinderance gives no continued impetus to the body, without which it must be out of motion, and which is only to be given by the physical cause continually impelling the body. Sir Isaac says, "if a body, from impulse once impressed, can afterwards move the shortest conceivable distance through empty space, I do not conceive why it should not continue for ever in motion." *If* the body could move even an inch after impulse, but which is unimpelled motion, doubtless it would do so for ever, but as this is self-motion there can be nothing less possible. As a body cannot move itself, so, when there is no physical impelling cause there can be no effect or motion. In fact it is as impossible to send a body through any portion of empty space, as a feather through a mountain of adamant, from there being no cause in empty space either to produce or continue motion. So that from taking away all resistance being no cause of motion, without an impelling cause there can be no impulsive, effect, that is, motion, on the plane.

The idea of motion being any thing of a communicable nature which one body receives that another has parted with, is obviously erroneous. A body may be impelled against another at rest and come to rest itself upon impact taking place, leaving the body struck in motion: still this is neither communication nor transfer of motion, inasmuch as the motion, that is, the moving condition of the struck body was not previously the motion or moving state of the body by which it had been struck. In other words the changing of place of one body could never have been or ever become the changing of place of a different body, any more than the spinning of a boy's top could have been the spinning of a different top transferred from one to the other. Motion may be propagated along a series of interlocked wheels without transfer of any thing from wheel to wheel. Being identical with that which is in a moving state, motion or the moving state of a body is nothing that may be transferred or communicated. A body parting with its motion to another, is but a mode of expression, stating, that the body has come to rest by putting another into motion. The striking body has come to rest solely because it has ceased to be impelled and the other is in motion by reason of it being impelled although not sensibly impelled. A body can as soon communicate to another its momentum as its motion. Not less irrational is the communication of force from body to body, without showing that force is something distinct from a body in a state of force. Force being nothing a body has to part with, is nothing for a different body to receive; the contrary is, a body acquiring another body's forcible state, which, from force being identical with that which is in motion, amounts to making the same of different things therefore an evident absurdity. Motion and force being the elements of momentum, which include body, their transfer implies the transfer of body into body, the unreasonableness of which establishes the unreasonableness of the theory of communication of force. Hence as the struck body receives neither the motion nor force of the one by which it is struck yet becomes in motion, it is obviously impelled by some insensibly impelling cause. From the foregoing exposition of the adopted opinions respecting motion and communication of motion, it must appear evident there is no foundation in reason for what is advanced as the cause of accelerated motion. Effects of motion, it is said, accumulate in the falling body and increase its motion. But what are these effects? The moving of a body is nothing of an accumulating nature; nor is it reasonable that effects of any kind could produce their like in an increasing ratio and much beyond their cause. A body impelled vertically becomes afterwards impelled downward; whence, it may be asked, is this contrary impelling force derived? The body had ceased ascending, it possesses in itself no contrary or descending force, and the force which precipitates it through the first portion of space cannot make it double its velocity in the second, much less can the velocity or effect double itself. According to all opinions ancient and modern of motion, if the cause be equable so should its effects: a body floating on an equally flowing stream is only equably moved. The cause is not the body, neither is its force nor the effect on the body capable of increasing itself. The planets evince nothing of accelerated motion: their constant motion is productive of no accumulating effects productive of increase of velocity. The fact is, there is no way of accounting for accelerated motion on the principle of the body's motion and force increasing its motion and force, nor otherwise than on that of increasing impulse. Still the cause itself is not accelerated or a body could not commence falling at the minimum of velocity no matter how high or low its fall commenced. An equable force can produce only equable motion, an accelerated force has no minimum of effect but at the very commencement of the force which may be considered the utmost limit of the atmosphere. So from a body commencing its fall with the minimum, wherever it may fall from, it is manifest the cause is not accelerated but equable, and hence it is inferable that the body itself, in its physical state, is changeable, by which it becomes more and more impelled during its descent by the same equably impelling cause, which will be made appear is most probably the fact.

A body cannot be put out of rest into motion unless it is impelled: impulse is indispensable. But what does impulse do to make the body continue in motion after the sensibly impelling cause has ceased to act on it. This cause can move the body no longer than it immediately acts on the body itself. Gunpowder, the hand, steam or mechanical means cease to act on the body beyond its own extent, yet by such previous means the body proceeds much farther through the air. By the previous impulse the atmosphere is not made to press less on front or more on the rear of the body; the body cannot go on of itself from giving itself force, nor from no immediately impelling cause: it cannot carry in itself that which carries it through the air and the effect is greater than the first impelling cause. From the whole of these circumstances it is obvious the body must be impelled through the air by some insensibly impelling cause. Being in motion it is evident the body is under unequal pressure on opposite sides: it is under greater pressure on the side of impulse and less on that in the direction of motion. Still there is nothing of unequal pressure evinced in any of the sensible means of impulse applied. The general pressure is unalterable by the previous impulse, yet the previous impulse is the promoting means by which the unequal pressure productive of motion is effected. From these premises there remains but the alternative, that, the previous impulse may effect some physical change in the body itself by which it becomes under unequal pressure, and from being so, is carried from the first impelling cause by the common medium of pressure, which is the insensibly impelling cause in every instance.

A stone thrown upwards from the hand is similarly circumstanced to a cork pressed upwards by water and to a baloon by the atmosphere. The equilibrium of pressure on the stone has been subverted and to the previous or sensible impulse only can we look for this being effected. Hence were we certain wherein consists the physical change the body undergoes by the previous impulse, which leaves it under greater pressure on its rear than front and thereby promotes its subsequent motion, in the pressure of the medium of space we have an insensibly impelling cause in every direction. That such cause every where exists is evident, from motion depending on its equal of impulse and all motion requiring but the same common cause. And that the medium of space is the cause of all terrestrial motion is inferable, from motion universally being but a common effect dependent on impulsive pressure and the planets having but this medium to maintain and perpetuate their motion through the regions of space.

It has been shown that all bodies contain free electric matter which is removable without injury to their general texture: that, until this matter be removed the medium of space cannot enter and produce expansion: and, that, by it preventing expansion it lessens the effects of the general pressure. This free electric matter therefore is a minus-pressure means. From these principles the cause of continuous motion is deducible.

A body that possessed no minus-pressure matter would be under a certain degree of pressure on all sides; if afterwards possessed of it, it is then under a less degree of pressure. Were it possessed of it on one side only, it would be under unequal pressure on opposite sides, the deficient side would be under greater pressure than the opposite sated side. Under these circumstances the state of rest must be disturbed the body must be put in motion, and, during their continuance, kept in a moving state.

Impulse is indispensable towards promoting motion. Still the immediate effect of the previous impulse on the body, whereby the motion is made continuous, is not the continuous motion; mere temporary impulse could not possibly produce this excess of effect. The body by this finite cause could be in motion only as far and as long as by it it is moved.

Three distinct effects are produced almost at the same instant from the velocity the body is put into while in contact with the first impelling cause. The body becomes de-electrised in its rear; it acquires the medium of space in the vacated part, and, by the greater pressure of the same medium on the rear than front, the motion of the body is impulsively continued after the sensible impulse has ceased.

A stone, impelled by the hand, leaves behind it in the air a portion of its minus-pressure matter, owing to the velocity of the hand, the first impelling cause, and to the momentum of the minor elementary matter being less, during the previous impulse, than that of the stone. The rear of the stone it is which becomes de-electrised, the front retains its minus-pressure matter. Hence the front is under less pressure than the rear. The medium of space immediately enters the de-electrised rear and in quantity proportional to the de-electrisation, which is proportional to the force of the previous impulse. The pressure of the medium of space thuswise increased on the rear, it is, which whips the stone out of the hand and impels it, beyond the original impelling means, through the air.

The previous impulse, in every instance of projectile motion, causes minus-pressure matter to vacate as it were, the rear of the body, its velocity being less during impulse than the velocity given to the body by the first impelling cause. Nothing else than de-electrising the rear, causing it to lose from that side minus-pressure matter so as to leave the body under unequal pressure, can be conceived, to constitute the immediate effect of giving the body the previous temporary impulse. Were dust on the body it would vacate the rear first, during the previous impulse: were a loose thread attached to the body it would follow in the rear of motion and did the thread break it would be left behind. The front can never be deficient of minus-pressure matter; it may even be said, the minus-pressure matter in front cannot vacate its place, for even were the body revolving round its axis in the air, the front or side facing the direction of motion is kept constantly sated with minus-pressure matter which it meets in the atmosphere during the whole of the trajectory.

A stone on the ground is at rest and is sated with minus-pressure matter which excludes proportionally the medium of space or force. To cause it to ascend into the air it must be impulsively moved, which impulse moves it no farther than the sensible cause extends, some other cause must move it farther or beyond this cause. The stone has no cause put into it by the first impelling means. The motion and state of force it is put into are but effects produced by the previous impulse: these can neither generate the like effects on nor impel the body. Impulse must precede, motion succeeds and is the measure of impulse; and as a body is perfectly passive with respect to it being moved, it is conclusive its motion through the air is effected by impulsive means the whole of the motion, which can only be by the medium of pressure acting more forcibly on the rear than front. To promote this state of unequal pressure there is nothing, in the first instance, concerned but the previous impulse, which can effect nothing but partial de-electrisation of the body, which, from leaving the body under unequal pressure on the opposite sides leaves it the patient of the medium of space by which its motion is continued after it has ceased to be in contact with the first impelling cause.

A body while at rest being sated with minus-pressure matter, and partially de-electrised when in motion, and from its motion being on the decline from the beginning, it follows that the decline and total cessation of motion are in consequence of the body, during its motion through the air, acquiring gradually its natural quantity of minus-pressure matter, which as gradually displaces from the rear all excess of the medium of space or pressure, so when sated equally on all sides the equilibrium of pressure is restored and the body ceases to be moved. It is the impelling cause gradually lessening, makes motion on the decline from the instant the previous impulse has ceased, not resistance of the atmosphere. According to the medium through which a body is impelled, it acquires the displacing minus-pressure matter in its rear more or less rapidly and in the same time is deprived of the impelling medium in the like proportion.

On the foregoing principle it is manifest impulse is as constant as motion: the maximum of velocity is during the maximum of the previous impulse and

and the cessation of motion is owing to the cessation of impulse.

Descending motion being accelerated while motion in every other direction is retarded, and from a body being unable of itself to fall much less give increased impulse to itself, it would appear, that, the impelling cause is in motion in the direction of what it accelerates; which is also inferable from it being much more difficult to move or lift the same body from the ground than put it into motion horizontally.

Equable horizontal impulse of moderate force and however long continued, being unproductive of accelerated motion, and as a body at every height commences its fall at the minimum of motion, it is not altogether to the impelling means we are to look for the cause of accelerated effects, but also to the de-electrising of the body in its rear more and more during it being precipitated. Horizontal motion is retarded from the beginning in consequence of returning minus-pressure matter displacing the impelling cause; hence it is inferable that in descending motion the contrary procedure, or, de-electrisation, takes place the whole of the descent, by which minus pressure matter is constantly vacating and additional increments of the medium of space are continually entering the rear of the body the increasing force of which latter makes the velocity be accelerated. Not only is descending motion accelerated, and the only which is so, but it indicates that impulse is in the direction tending towards the earth's centre. Premising then, that, every physical effect deducible from pressure, motion and position not only arises out of the general order but is subservient to its continuance, the following may be advanced as the probable cause of descending motion and various other phenomena.

HYPOTHESIS.

Centripetal Flow.

In consequence of the several different motions of the earth, the pressure of the medium of space is less at the axis or centre of motion than on the surface of the globe; which is productive of the flow of the medium of space along the axis to and from the poles and a consequent centripetal influx of the same medium through the atmosphere and surface of the earth to the axis.

To a flow of this kind the following phenomena may be referred—the atmosphere having weight and being retained to the earth during the whole of the various motions of the earth. Bodies being ponderable, their fall centripetal and their motion accelerated. Horizontal and vertical motion, from being opposed by the centripetal flow, retarded. Electric matter productive of minus-pressure visual effects forcibly escaping boreales-like at the poles. The direction of the compass-needle indicative of the polar efflux of the centripetal flow.

PRINCIPLES OF MOTION.

I.—Impulse is indispensable to the continuance equally as commencement of motion.

II.—Matter being inert a body can neither impel itself nor keep itself in motion.

III.—The motion and force of a body, from being effects of impulse, cannot continue motion much less increase the velocity of a body.

IV.—The impelling cause must be something foreign to the body impelled and in contact with it the whole of its motion.

V.—Impulsive pressure, applied unequally on a body, is productive of motion the whole of its continuance, but where it ends motion ceases.

VI.—A body moving through the air is under unequal pressure on opposite sides.

VII.—The medium of space is the continuously impelling cause.

VIII.—The sensible, or previous impulse, causes the projectile to lose minus-pressure matter from its rear, which leaves the body under unequal pressure by the medium of space.

IX.—As the projected body acquires minus-pressure matter in its rear, the unequal pressure it is under becomes reduced and the motion lessened: when the rear becomes sated, the pressure is equal on all parts of the body, impulse is at end and the body at rest.

X.—The centripetal-flow causes decending motion. It de-electrises the rear of the body more and more during the entire of the fall, which increases impulsive pressure in the same proportion and causes the descent to be accelerated.

MOTION.

Horizontal Motion.—Fig. 25. A is designed to represent a body at rest sated with or possessed of its natural quantity of minus-pressure matter, previously to it being impelled horizontally through the air by any species of mechanically applied force. B the same body after having been impelled from A to B, that is, as far as the first impelling cause extends. C the de-electrised rear of A when at B, D the front possessed of its natural quantity of minus-pressure matter. E shows, in the outwardly converged dots, the minus-pressure matter left behind. The parallel lines at F represent the medium of space which enters the de-electrised rear of the body. G shows the state of A when at B, de-electrised from being impelled, in the same figure; the dots are the vacated minus-pressure matter, the light part of the figure the de-electrised rear and the parallel lines the medium of space entering the de-electrised portion.

The state of G is that to which the body is and all bodies are brought by the previous impulse when the body is first made to part from the sensibly impelling cause. The motion which follows is caused by the pressure of the medium of space on the de-electrised rear of the body.

G represents A when at B under the maximum of force, or of force equal to that of the first impelling cause. Afterwards the motion declines, in consequence of minus-pressure matter returning, shown in the figure H by the inwardly converged dotted lines, which matter, by displacing its equal of the medium of pressure, causes the motion to decline. IK show, in the light part of each, the increase of acquired returning minus-pressure matter and in consequence an equal loss of the medium of pressure, therefore the further decline of motion. L is the projectile when having become sated with minus-pressure matter to the exclusion of all excess in its rear of the impelling menium, by which it is under equal pressure on opposite sides, rear and front, consequently at rest.

The first impelling force causes the body to vacate from its rear some portion of its free minus-pressure electric matter, as would be any light substance loosely attached to the body; while from the front nothing of the kind can happen: on the contrary the front acquires the like matter as the body is being impelled. The de-electrised rear acquires the medium of pressure, in proportion to the degree of de-electrisation, the pressure of which causes the motion of the body to be continuous. Minus-pressure matter begins to return from the instant the previous impulse has ended and displaces in the same degree the medium of space which makes the motion be declining. So when the rear of the body has acquired its full complement of minus-pressure matter, it is pressed equally on all sides which leaves it unimpelled and at rest. All motion and in every direction is promoted after the manner above described.

In all subsequent figures, the outward converging *dotted* lines E represent minus-pressure matter left behind and by those inwardly converging H is meant returning minus-pressure matter. The light part of the figure is the vacated rear, the dark portion that which possesses its natural quantity of minus-pressure matter. The parallel lines stand for the medium of space, the pressure of which on the de-electrised rear, is, in every instance, the cause of continuous motion. Hence in the plate each figure is to be considered complete if not so delineated; and, in description, the reader is to supply what has been omitted in avoiding unnecessary repetition. It is to be understood likewise, that, in all instances of motion where de-electrisation in the rear is mentioned, it follows that the medium of pressure enters the vacated part.

ASCENDING MOTION.—Fig. 26. A a body at rest on the ground. B its situation and state where the previous impulse ends. Its de-electrised rear has acquired the medium of pressure which forces it upwards to E. The whole of the way the projectile is acquiring minus-pressure matter and losing the impelling cause by which the motion declines from B to C, moreso to D and ends at E. At E, although not fully sated with returning minus-pressure matter, it does not ascend, but is supported in the air for an instant against the force of the centripetal flow.

DESCENDING MOTION.—Fig. 26. As the medium of pressure becomes displaced by minus-pressure matter returning to the rear of E, the projectile becomes unsupported and precipitated by the centripetal flow as to F, during which, minus-pressure matter vacates and the medium of pressure enters the rear. Being still impelled by the flow the body is further de-electrised in being precipitated to G, moreso as it arrives at H, moreso at I. It loses minus-pressure the whole of the way from F to K and acquires additional increments of the medium of pressure as de-electrisation proceeds, the motion of consequence is accelerated. On striking the ground at K the body acquires all its lost minus-pressure matter and remains at rest.

Were there not a centripetal flow there is nothing to cause the body to return to the ground: and as accelerated motion depends on increase of impulse the whole of the way, while the flow cannot be but equable, there seems nothing contrary to the adopted principles, that, the fall is a precipitation by the constant flow; and acceleration of the fall the consequence of the body becoming more and more deficient of minus-pressure matter and acquiring the medium of pressure in its rear as de-electrisation proceeds. Another indication of there being a centripetal flow, is, the circumstance of there being no acceleration but in the direction of descent: and as by such a flow motion in every other direction should be retarded, which is the natural fact, the *Hypothesis* may not be altogether chimerical.

The centripetal flow being productive of weight, weight and momentum are the same; hence as momentum is increased the same body is heavier at one time than another and weight is necessarily in the direction of impulse. A body may be horizontally moved so as to have no downward weight, or not depress a weigh-bridge in the least. All bodies being under the centripetal flow are pressed towards the earth and according to their quantities of matter are made ponderable, and more ponderable according to their deficiency of minus-pressure matter. Thus, a piece of scantling, supported by an upright post under each of its ends, that shall support a hundred weight in the middle, will be broken by half that weight let fall on it although the momentum at the end of the fall is but one hundred. At the beginning of the fall the weight is fifty at the end one hundred: for at the end it would lift one hundred in the opposite scale into which it might be let fall. The fifty let fall breaks the scantling because it de-electrises the wood at the place of impact, the hundred does not effect de-electrisation from being placed gently on the wood: the medium of space rushes into the de-electrised portion and assists in making the fracture. It is similar with breaking a stone by a hammer. There is no difficulty in accounting for a knife under force dividing a cheese, but the hammer does not enter the stone. The hammer does not divide the stone, the medium of space is the splitting cause, which enters as the hammer effects de-electrisation of the stone and causes the various directions of motion of the pieces, each of which has its impelling cause, which cannot be imputed to the single direction of impulse of the hammer. Weight being momentum it is lessened in one direction when increased in another which makes a stage-coach continue running on three wheels that falls when the horses stop. The coach is de-electrised in its rear by the motion of the horses and acquires momentum in the direction of motion, not by its motion but the pressure of the medium of space on its vacated or de-electrised rear; as does a man running. The force which propels a man along the ice—of less strength than his own weight—on skaits or over a ditch in leaping, is that of the pressure of the medium of space, the previous exertion de-electrises him in the rear of motion for the reception of this medium.

Reflected Motion.—Fig. 27. Two ivory balls CD suspended by cords of equal length from the point T, when raised to equal heights in opposite directions, each at the full length of the cord, and let free from the hand, both are precipitated by the centripetal flow, both leave minus-pressure matter behind, each acquires the medium of pressure more and more during the descent which accelerates their motion. Previous to their mutual impact the physical condition of each is as represented at DC. After impact has taken place they become impelled asunder as BA. The concussion causes the minus-pressure matter in the side C to vacate that side and occupy the opposite, and that in side D to occupy its opposite. The vacated sides CD are now as the sides BA into which the medium of pressure enters and forces the balls asunder.

In like manner when F is let fall, that is, allowed to be precipitated from the air, it becomes de-electrised more and more in the rear during the whole of its descent and before striking on the marble slab MN is circumstanced as G. At the instant of impact the minus-pressure matter in front P, vacates that side and occupies the opposite as at K. The now vacated side Q acquires the medium of pressure which lifts the body suddenly to I. From I to H returning electric matter is displacing the medium of pressure and the ascending motion of consequence declines.

That reflected motion is caused by any action of one ball against another is in contradiction to the law, that, equal opposing forces destroy each other. The rebound being less in height than the fall militates no little against the common phrase, "action and re-action are equal." That, at the instant of impact, the ball and slab become altered in shape at the points of contact and each impels the other from the sudden restoration of form is incredible. Besides, the expansion could not exceed the original circumference of either ball, nor surface of the slab, and from these expansions being opposed to each other nothing of rebound could be effected.

PENDULOUS MOTION.—Fig. 28. The ball of the pendulum ZC being lifted up to A is, while in the hand, at rest and sated with minus-pressure matter: when let go some portion of its electric matter is left behind from the side B in the rear of motion and more continually during the descent to C, in consequence of being impelled the whole of the fall by the centripetal flow. At C the medium of pressure in its rear forces it to D thence to E. From C to E it is opposed by the centripetal flow and acquires returning electric matter, which, by displacing the medium of pressure leaves it under reduced velocity. At E it is supported against the flow. Now taking FHK the returning vibration, at F the force of the centripetal flow overcomes the support, represented by the parallel lines E, by the medium of pressure; the body then becomes de-electrised in the rear F, is precipitated to G thence to H, thence is lifted to K as before, and during the ascent it is acquiring minus pressure matter, as at I, which displaces from its rear the lifting cause or medium of space.

Probably a ship's velocity is ascertainable by the pendulum. Thus, let A represent the state of the bulb, on land, before it falls. The light side of C is the measure of force, velocity, or momentum at the end of the fall. Then the light side of F is the measure of the ship's velocity and shows the de-electrised state of the bulb before it falls, owing to the motion of the ship. At the end of the fall, on board, the force at H is equal to the force at C plus the force at F, and the excess of force at H over the force at C gives F the force or velocity of the ship. Or taking I the ascent on land, K is the ascent on board to be valued in knots or miles by an index. The velocity of the pendulum on land being known, its velocity at sea includes the land and sea velocity, the difference is the velocity of the ship.

Rolling Motion.—Fig. 29. A a ball in its sated minus-pressure state lying at rest on a horizontal plane. When impelled by the hand to B and the hand withdrawn, it is, as in the figure, de-electrised in the rear and impelled forward by the medium of pressure; but on account of being at the same time pressed downward by the centripetal flow its vertical axis becomes upset as at C. While being impelled towards C the ball is retarded by its pressure on the plane, and from these circumstances taking place the entire of its forward motion the ball is made to perform a rolling motion. The pressure on its rear keeps the rear continually, in some degree, de-electrised, but less and less at every stage of advance, and from B to E, that is, from the end of the previous impulse to the ball coming to rest, returning minus-pressure matter is displacing the medium productive of motion.

DIAGONAL MOTION.—Fig. 30. Rectilinear motion being in the direction of impulse or of greatest impulse, so when the body SV, although struck by a force moved in the direction RQ, is impelled in the direction VT, MS is the direction in which the medium of pressure acts on the rear of the body in the strongest matter.

Were the body B struck by a force moved from A to B, the side B would be de-electrised: were it struck in the direction DC, the side C would leave its minus-pressure matter behind, and were it, at N, struck at once by the two forces, as from HE, it would be de-electrised in the three quarters FGN. The quarter O is not de-electrised: the quarters FN are each but once or singly de-electrised, while G has been doubly de-electrised. So that although the medium of pressure rushes into FN, the vacuity in G for admission of the medium is greater than in either. LG is the direction of strongest impulsive pressure, consequently QP is the direction of effect.

The Whirling Table.—Fig. 31. A body placed at the centre A, the table being revolved, is revolved round its own axis by the table: but when removed from the centre and placed at T, it is carried by the table in the direction TB and during its motion becomes de-electrised in the rear. It is now under two forces, the table, and, in its rear, the pressure of the medium of space. The first alone would move it in a circle, the second of itself impel it rectilinearly or, in a tangent to that circle, to E. Both acting at once on the body prevent it moving in the circle BHT or in the direction BE: by both it is moved along the dotted line BC. During its approach to C it is more and more de-electrised, and while carried round by the table the medium of pressure on its rear forces it across the circle of rotation CG, whence, by the two forces, it is made to take the direction of the dotted line CD. When forced beyond the margin at D it is moved by one force only, the medium of pressure, by which it is impelled towards F.

Throughout the whole there is nothing of centrifugal force or centrifugal effect. At the centre were any such force generated it would be most strongly evinced and the effect, motion, in the direction of radius. And although the body is made to recede more and more from the centre, its direction of motion TBCD is not centrifugal but curvilinear.

Newton says all motion is rectilinear, and to make it otherwise two forces must act differently on the body at the same time: but the motion of a fly-wheel and by a single power is not rectilinear; and on the whirling table, in moderate motion, a body may be made to perform a perfect circle by a single force.

A stone revolved in a sling is circumstanced similarly to one on the whirling table. At every revolution it becomes more de-electrised in the rear. Were the sling to break at the bight, centrifugal force would then be evinced by the stone flying off, not at right angles, but, in the direction of the sling, in a straight line from the centre of motion, the hand. This being impossible it is evident, the force by which the stone is impelled is not in a centrifugal direction but in a direction the same as that of the effect.

ROTARY MOTION.—Fig. 32. A fly-wheel ABE unconnected with machinery, turned by the hand applied to a winch. The arrows indicate the direction of motion. The surface of the periphery, also each of the arms, while in motion, suffers loss of minus-pressure matter in the rear of motion and in greater proportion as the part is farther from the centre of motion. Into every de-electrised part the medium of pressure enters, the force of which it is that turns the wheel after having been set going; and in de-electrising the whole lies the difficulty in first setting the wheel into motion, the general pressure against the minus-pressure matter in the wheel having to be overcome before the minus-pressure matter can be displaced for the admission of the medium of space.

When the hand has been withdrawn from the winch the wheel continues revolving; it is then under way, because the medium of pressure is but gradually displaced by the returning minus-pressure matter. All circumstances considered, the mistake is obvious, which assigns the facility with which the wheel is kept in motion by the hand at the winch and a similar wheel of a turning lathe by the slightest pressure of the foot against the treadle, to force put into the axis which proceeds to and accumulates in the periphery. That the medium of pressure acts obliquely on the de-electrised parts, as the parallel lines FF indicate is obvious, from there being no motion produced by a force tending from the periphery to the fixed centre. Still it is the parts of the wheel are rendered oblique to the pressure as the machine is being revolved.

The wheel comes to rest when all excess of the medium of pressure has been removed by the returning minus-pressure matter—not by force going out, nor resistance of the air—but from the natural power being withdrawn, and this being effected not instantaneously but gradually, leaves the wheel in a state of declining motion after the hand has ceased to be applied to the winch.

A ship under sail does not immediately stop when the wind has dropt; a steam vessel when the steam is shut off; a boat when its oars are shipped, nor a coach when the horses have been checked; each has been de-electrised in the rear while kept in motion, and from each the medium of pressure requires time to be wholly displaced. It is the medium of pressure acting on the rear of a man or horse which prevents either stopping suddenly in the middle of a run.

PLANETARY MOTION.—Fig. 33. Let WE represent the earth, NABCS the earth moving in its orbit, SS the sun. The parallel lines at ABC the medium of space pressing on the de-electrised rear of the planet. The numerical figures are assumed degrees of pressure.

Were the pressure of the medium of space on the side S greater than on the opposite side N, the body of the planet would be moved in the direction NG. Were the pressure at the same time greater at W than

E the motion would be in the diagonal direction EA. But were the Sun s the cause of the pressure being less at E than W the motion would be in the curve line NA. This state of unequal pressure being constant and the sun stationary, the earth would be moved round the sun, maintained in endless revolving motion and its orbit a perfect circle. And as much as the excess of pressure at S exceeds the excess at W, so would be the radius-vector or distance at all times of the earth from the sun.

The earth being in motion it has obviously greater pressure on the rear than front, on the side S than N, on the side facing the south than north. Then as the east or solar regions are more rare the nearer the sun, on the western side of the earth the pressure is constantly greater than on the eastern. In these natural means there is competent cause for the earth being in endless motion and the motion orbicular. Impulse is endless and the minus-pressure means constant. There needs none of the assumed central forces: no gravitating by the earth, no centripetal inward drawing by the sun, no projectile force to start the earth into motion at the beginning to leave it in endless self-motion under any attractive influence of the sun.

The motion of the earth, however commenced, leaves the body of the planet permanently de-electrised in the rear, while in front minus-pressure matter may accumulate but cannot lessen; by which the pressure on the rear is necessarily and constantly greater than on the front in the direction of motion. In addition to the sun and solar regions there is, for minus-pressure means, on the east, always existing in the atmosphere and as it were flowing into the hemisphere facing the sun, electric matter forced daily towards the rarer, which is the eastern, hemisphere of the earth's atmosphere. On these minus-pressure means, together, depend the difference of pressure on the sides EW, east and west of the earth.

The daily minus-pressure matter constantly pressed through the atmosphere to the solar side, is the means of producing the visual pressure productive of the perceptions familiarly named daylight, break of day and twilight, and most probably of the boreales phenomena. When the eyes are directed to the east, just before sunrise, it is imagined light is pouring into the atmosphere from the eastern hemisphere. While the sun remains above the horizon our hemisphere is full of this electric matter, and which, is a hinderance to any visual pressure being promoted by the stars. Hence it is said we cannot see the stars for the light. When the sun has sunk in the west, this daily electric matter, in following the sun, vacates our hemisphere, the latest retiring portion of which affects the optic pressure on the retina so as to promote the perception named twilight or the crecuspule.

From the foregoing outline of a theory of orbicular motion, it follows, that, as the sun is not stationary its motion must necessarily affect the earth's orbit and cause it to vary from a perfect circle; and that, as the minus-pressure means on the north and east of the globe may fluctuate in quantity, the orbit is subject to mutations, some imperceptible, some deducible from the seasons being irregular and extreme.

In the whole suggested, there is nothing but natural physical means and constant impulse. The whole self-acts and self-regulates. Were the sun to stand still the earth could not, but its orbit would cease to be eliptic and become circular, which must happen at the same time to every planet in the solar system. The irregularities of the planets cannot greatly increase while restoring means are so intimately connected with their motions. The principle of disorder is unconnected with the system. That in time the restoring hand of Deity would be requisite to replace, in His own divinely-formed works, primeval order, is a notion unworthy the mind of man, of the Astronomer most unworthy. God theorise and plan without infinite prescience, who can think !!! Let us rather say with Leibnitz—the world is a machine that should proceed for ever by the laws of mechanism in the most perfect state by an inviolable necessity.

Of the central forces, such as projectile, gravitating and solar-centripetal, said to cause and continue planetary motion, the whole are hypothetical and inconsistent with the principle of inertia. A planet cannot keep in motion from no cause; nor can it be the cause of present motion that which impelled centuries back and then ceased to impel. In the next place, from motion depending on impulse it cannot be out of the direction of impulse. Were the earth originally impelled from F to S and even could it proceed from S without being further impelled, SG must be its direction. When between NG were it drawn by the sun, the novel direction implies not only a novel impulse but all effect from the first impulse being at an end. Were NS a billiard-ball struck by a force moving in the direction FS and impelled towards G, and any where between NG were it drawn by a thread towards SS, it is then acted on by no force but that of the thread. So were the earth, from being attracted centripetally, drawn out of the original projectile-force-direction by the sun, the projectile force and its effect are at an end and the novel direction could only be to and terminated at the sun.

The gravitating theory not only makes the earth gravitate to the sun, but the sun attract and draw the earth towards itself. Two such forces are sufficient to destroy orbicular motion even did the original projectile effect continue after impulse. There is not imputed to the sun other than a drawing-in power, an attracting power which diverts the earth's motion out of the original rectilinear into curvilinear and orbicular, which evidently leaves the planet free of all impulse and effect but that which tends towards the sun. From which it is evident the central forces are not only hypothetical but unfounded, in no respect supported by the phenomena they are meant to promote and contrary to the law of motion, which maintains, that, any change in the direction of motion depends on impulse being renewed in every novel direction. That there is nothing of the central forces causing the orbicular motion of a planet is evident from their acting in conjunction being impossible, for where one is said to commence acting the other ceases to act.

It is but natural to an inert mass of matter and is fundamental in dynamics, that, when the direction of motion is changed fresh impulse has taken place. Then, as a planet may be said to move in every direction, as from N to A, then in the contrary direction to B, thence round to Q, thence backwardly to N; by which there should be as many renewing causes of impulse as changes of direction, a construction and proceeding too anomalous to be for an instant entertained in idea. Nothing but a medium of pressure and minus-pressure means are required to produce the phenomenon, orbicular motion.

The diurnal motion may take place somewhat after the following manner. The daily electric matter being in constant flow westwardly and the earth in motion, leaves the pressure on the opposite side of the earth unstable, as is the lesser pressure on the solar side at the same time. Under such circumstances the body of the earth is of necessity kept revolving round its axis.

As the sun is a minus-pressure means to the earth, so may the earth be to the moon, and the latter be retained in the vicinity of the former as are the planets in that of the sun. And as the solar system is but a portion of the system of the universe, the moon is held in its position to the earth as the planets in their's to the sun during the general transfer of the whole through the immensity of space.

Animal Motion.—The motion of animals in air and water depends on the common pressure being promoted by voluntary displacement of minus-pressure matter within the body.

It is not the fact that the power or rather faculty of volition makes us move; we may will to go forward and will to stop, but without the muscular mechanism neither leg nor arm can be moved; if the muscles be destroyed willing cannot make us walk, it cannot cause the body to perform locomotion, the leg to move or the arm to rise. The will is not a cause, it is only a director of animal motion.

That animals have the power of de-electrising their bodies, that is, of transferring the minus-pressure electric matter within them from one part of their body to another, for the purpose of receiving in its place the medium of pressure, is inferable from various circumstances.

Were a bird, upon ascending from the ground, de-electrised in the rear as a stone when forcibly impelled, it would be impelled as is the stone after the previous impulse and by the medium of pressure forcibly entering the de-electrised part. But a stone cannot change its direction of motion, the bird can at the command of will. The flight, it is thought, the wings effect by striking the air as the oars of a boat strike against the water. But when the action of the wings is the same during every change of direction of flight, it is obvious some other physical cause and at the command of will is concerned. A crow, for instance, ascends from the ground while flapping his wings nearly against his sides, yet at a certain height flies at right angles to the ascending direction and flies horizontally with the same performance of wing. Afterwards his flight may be in a circle, which includes every direction of motion, the wings maintaining the same direction of flapping; or he performs a circle in the air with motionless extended wings. How is a bird to give force to its own body. A swallow darts through the air with closed wings and alters its direction at will, by reason of it being enabled, at will, to transfer minus-pressure matter from one part of its body to another for the medium of pressure to enter the vacated part the force of which is the bird-impelling cause. During the most rapid motion of wing the hawk at times does not fly, but remains stationary over a smoking chimney in frosty weather, and then, from that place in the air, darts on its prey with a momentum much greater than did it fall from having been shot. When an eagle sails on extended wings, it cannot be maintained the buoyancy of its enormous body is owing to extent of surface, or an unloaded parachute of much larger surface could not descend. Although wings assist flight, and at times its change of direction, the pressure of the medium of space is the truly impelling cause and doubtless the action of the wings contributes to keeping the interior of the body in the de-electrised state necessary for maintaining it under unequal pressure. Were wings the sole impelling means, domestic fowls would fly as other birds. The tame duck has larger wings than those of dunghill cocks and hens, yet possesses but little power of flight.

It is this voluntary ability of what may be named, unequalising internal pressure, that enables flies and lizards to walk back-downwards on ceilings and the enormous Walrus on floating ice. It cannot be said the fins of fish are sufficient to impel their bodies arrow-like through the water: it is owing to the air in the swim being de-electrised in the rear, perhaps from being voluntarily compressed toward the front, and leaving the rear under excess of pressure. By similar means the oyster de-electrises the cartilage and perhaps the shells of his house, leaving the whole under an excess of external pressure. The ligament at the joint may be divided, the shells broken, yet until the oyster is rendered lifeless, or separated from the cartilage, the difficulty in opening is nothing lessened. To overcome the collapse requires a force much greater than the tenacity of the fishy cartilage. The limpet is held to a rock by external pressure, which is subverted at the will of the animal instantaneously and the shell drops off the rock suddenly. How is the no-palmed, all-fingered lizard to make a vacuum at every step during its rapid movement, or the Walrus with only two feet on the ice at once while walking. The worm is forced forward on the same principle as birds and fishes. Perhaps proof might be obtained experimentally, by placing a goat or cat in a scale counterpoised with weights, the scales being considerably elevated above the ground, whether the animal when scared would not make its scale preponderate. Somewhat of the kind takes place within the human frame on several occasions. Muscular leverage could never empower a man to carry himself up into and through the air while leaping: in skaiting he makes no impelling effort, after fitting his body by the previous exertion, for being impelled. When the body of a man on his knees is pierced by a musket ball it instantly becomes whipt up several feet into the air, which is by no exertion of the man, much less of the lifeless body, but arises from minus-pressure matter being set free and the medium of pressure entering the vacated place. To which may be added death by the wind of a shot. The shot is deficient of electric matter in its rear; the body it passes gives the like out, and the acquired excess of the medium of pressure within the body breaks the bones and forces the humours outwardly in tumours and blisters. There are but few who dance with their entire weight on the boards. A *Taglioni* of two hundred and fifty pounds weight, if dancing in a scale, would not, at times, elevate ten pounds in the opposite scale; when performing cutting-steps in the air her whole weight is lessened on the scale, not by herself, but the medium of space internally pressing her upwards.

The effects of galvanic application on human subjects, which are promoted by drawing off electric matter from the nerves and muscles, show, that the common principles of action, under systematic order, are concerned in promoting the whole of the animal functions. Muscular contraction and expansion, in degree, naturally take place after life has become extinct, the like as while vitality is connected with the body. The heart of a turtle is inflated and collapsed many hours when out of the body. The flesh of veal, particularly of the neck, is in expanding and contracting motion long after the animal has been killed: so would the flesh of any other animal similarly de-electrised, by reason of electric matter and the medium of space entering the part and becoming alternately displaced. It is not superstition altogether which first prompted the application of a dead hand to effect the removal of a wen. Sudden death presents an extreme case of electric circulation, from which it is presumed contact between the hand and wen will excite circulation in the latter. But some covered part of the body is better than the hand. The application should be immediately on life becoming extinct and the wen moistened or covered with some conducting, that is, electro-communicating substance. To which may be added, that, in electrifying applications to the human body in a living state and in promoting resuscitation, it should be ascertained whether the operation does not effect the contrary of what is intended, if electric matter be communicated it is contrary to the de-electrised result by friction.

The voluntary power possessed more or less by animals of de-electrising their body in one part and transferring to another the minus-pressure matter, is the cause of the change of visual effect by the cameleon, which makes it be imagined the animal, at will, changes his colour. By a similar operation the electric eel may promote a sudden flow of minus-pressure matter from the hand and body generally, attended with an equal sudden influx of the medium of pressure the force of which gives the electric shock as in all similar instances; the preventive against which, perhaps is, to lay hold of the animal by insulators; the remedy, plunging the hand and arm in sated water, water nearer 30° than 60°. On these principles it is conceivable how the fire-fly promotes the sensation of luminousness to spectators intermittingly and doubtless to itself, how the porcupine discharges its quills and the turkey-cock raises its feathers.

As a body is pressed forward by the medium of space when de-electrised in the rear, the same forcing cause, under similar circumstances, is most probably that which discharges the contents of the intestines into the rectum and the fœces from the rectum, also the fœtus from the womb. Costiveness may proceed from the contents of the rectum being in a condition incapable of de-electrisation at will; and throes of nature from de-electrisation at intervals, during which parturition is promoted by the medium of pressure.

The foregoing ideas will, I trust, be canvassed with advantage by the truly philosophic physiologist and induce him to refer to physical cause in every instance wherein effects are produced in the animal system, the most grand performance of productive Nature, instead of substituting those unmeaning phrases so elaborately displayed in the writings of the Faculty and dealt out to their Patients, such as irratibility, stimulus, excitement, morbid sensibility, action of an organ regardless of what makes it act.

As every physical performance is caused by the single Power of Nature, Pressure, so all promoting means consist in the transfer of minus-pressure matter to effect unequal pressure.

COMETARY MOTION.—Unlike a planet, but like unto any other projectile, a comet is impelled in every direction. In a comet we have what may be considered, the signs at least, exemplified of the foregoing principles of motion. The tail may be said to consist originally of vacated elementary matter from the rear of the body of the comet; the coma electric matter collected in front.

Were the office of a comet that of collecting all once used elementary matter, given off from the planets and redundant in space, and returning the same to the Sun as the heart of the system for future circulation among the planets, it would be so constituted as to be impelled by the medium of space towards the sun, and from the sun when it had parted to the solar regions its gatherings.

That a comet is impelled forward from being under greater pressure on its rear than front cannot be denied. In which case it is circumstanced as a cork in an interminable medium of water and as a stone, after leaving the hand, impelled by the pressure of the medium of space acting more strongly on its rear than front. The tail, from being so much vacated minus-pressure matter, may be pressed after the body in consequence of the latter lessening the general pressure on the former. The tail, from consisting of atoms, may have interstices into which the atoms of all redundant elementary matter may be pressed, and the whole constantly pressed after the body of the comet. The coma may contribute elementary matter to the body and the body to the tail, and thereby contribute to the enlargement of the tail and accumulation of collectible matter. As the quantity thus collected may cause the general pressure to direct the comet towards the minus-pressure solar regions, so, into these regions, may the contents of the tail be forced; and at the perihelium, after delivery, the pressure may be such as to remove the comet from the sun to repeat a similar proceeding.

The coma, from being minus-pressure matter, lessens pressure in front, and if on the increase, lessens it more and more, which leaves the pressure at the rear of the comet on the increase productive of increased velocity of the body in its approach towards the perihelium; during which, as deposit takes place in the solar regions from the coma and tail gradually, the motion towards the sun would be declining, and when the comet became sufficiently unburthened and its original de-electrised state restored it would be pressed in the direction of its aphelion.

Were the elementary matter to be collected in a comet's tail abundant in space and situated between the planets—and what these bodies cannot retain it is but reasonable to suppose would be found some distance from them—this might regulate the trajectory and be the means provided against concussion of comet against planet. That preventive-means exist, is as certain as that the system cannot bring forth the blunder of an unforeseen imperfection. It is from the minus-pressure tail of a comet danger might result to a planet. By its too near approach to a planet the waters of the planet would be forced up into the tail as into an amazing waterspout, and which, on falling, as the planet revolved or the comet withdrew, would for a while deluge the hemisphere of the planet on which it descended.

The rapid motion of a planet in its orbit is said to counteract solar centripetal attraction. Were this the fact there might as well be no solar attraction; and that there is none is proved by the sun not attracting a comet to itself, although it moves with the most immense velocity, not only round, but towards the sun; yet, instead of being drawn on the body of the sun, it flies, almost defyingly, away from the sun with the most inconceivable speed.

The foregoing hints may be mere ideal, however, the little information Astronomers have promulgated on the subject of comets leaves full opportunity for conjecture. One other hint may be suggested as to what appears an essential difference between a comet and planet beside the peculiar office here assigned to the former. A planet has an atmosphere which remains as such during the whole of its motions: the comet, it is presumable, has none and that if it had one originally it is left behind and constitutes the reticle of the tail. It has been hypothetically advanced, that a centripetal flow of the medium of space into the earth is caused by the motion of the earth, perhaps principally by the diurnal motion, and that this flow retains the atmosphere to the earth; from which it may be inferred that as diurnal motion is useless to a comet its atmosphere is not retained but in the state of a tail.

MISCELLANEOUS.

VISUAL PERCEPTION WITHOUT EYES.—In proof that perceiving visually does not consist in the eyes seeing, is most singularly evinced in the case of Miss McEvoy, of Liverpool, who could see and read without eyes. The history of the case is this:—About twenty years since, it was discovered by the parents of the young woman, whose age might be twenty or rather under, that she could read by her fingers as others by their eyes. The discovery happened thuswise: she had lost all use of her eyes, and, on some occasion of a disputed text, offered to find the verse in the Bible. Being questioned by her father how she could, she took from the surbase a reading-lens and applied it to the pages successively until she found the identical verse. The phenomenon being made public she was visited generally. Among the Faculty, party spirit ran high and her Physician, Doctor Renwick, was not well treated. It was considered an imposition, notwithstanding every means of discovering a cheat were fully allowed the public and tried. The Revd. Mr. Harris, a Unitarian Preacher of Liverpool, informed me he had bandaged her eyes himself in the completest manner; he was convinced there was no imposition, but said nothing, owing to the bad feeling among the parties and, like the rest, from being Newtonian, could not conceive a book could be read unless rays of light came from it into the eyes; yet how the retina feeling rays could make the letters be seen he could not tell. When the eyes of this young woman were most completely bandaged, she read a book, covered with the bed counterpane, by passing her fingers over the letters. When asked to tell the hour of the day by a watch, she touched the glass of the watch and replied, it is twelve, or one of the hands has been taken off. Of pieces of silk within a vial bottle she named the colours under every disadvantage of bandaging. Shortly afterwards she died. This was a case of bodily disorganisation as her premature death implies. This truly visual perception—not feeling and from being taught what name or colour to apply to this or that feeling, as now practised with the blind—most probably arose from inosculation of the nerves of the eye and feeling sense perhaps within the brain. A leading feature in the case is, that before she lost her eyes and when reading, with her fingers on the printed words, there was no breaking heraltogether of the habit of pronouncing each word twice, as if she read both by her fingers and eyes. Until she became blind, the finger-seeing faculty was undiscovered. Nothing can show the fallacy more of seeing outwardly by image-making rays inside the eyes than this most singular case.

MEDIUM OF SPACE.—When writing a letter the fingers placed on the paper some distance from the pen are tickled, the paper being stiff. The motions of the pen on the paper disturb the medium of space within the paper and promote the sensation. The same medium it is, which, from being disturbed by the motions of a watch, makes it be thought "the ticking of a watch goes through a beam of wood." Houses and persons in bed are shook while heavy carriages are driven rapidly over the pavement; in consequence of the medium of space being rendered discontinuous where the wheels come suddenly in contact with the stones. Let it be conceived we live in a medium of water, every similar separation and reunion of the medium would be productive similarly of general agitation.

MINUS-PRESSURE MEANS.—Electric or minor elementary matter lessens pressure on a body, owing to the momentum of its atoms being as their size: to which may be added, the farther from the source of power the more reduced is the effect; which is exemplified in any system of machinery depending on a single motive power and turning an extended spindle the motion of which keeps remote mechanism in motion. The more simple exemplification is that of a turn-screw and the hand. The carpenter imagines, that, with equal force of hand a long turn-screw is more powerful than a shorter, because the longer turns a rusty screw which by a short one cannot be moved. The fact is, power is lost by the longer; resistance it is which is reduced. The longer is the lesser power. In screwing, the force is in the direction of the required effect, forward; in unscrewing it is the same to produce the contrary effect. A screw of difficult removal is much pressed in a direction the contrary of what is wanted; to make it ascend is the object, pressing it into the wood the act. In unscrewing, the hand uses its force in two directions, forward to keep the tool in the slit of the screw, rotary to produce the turning and consequent ascent of the screw. Lessening the forward force on the screw is the object gained by the longer instrument: the whole of which forward force is got rid of when the screw has a head that admits of a winch. The tool may be uselessly long ; the forward force by the hand being as before, it may be insufficient to command the position of the tool in the slit and too weak to produce any turning effect: or should the slit be deep enough, the greatest effect will be on some part of the blade of the tool in a twisting direction. The carpenter little thinks his exertion is employed oppositely to his intention or against himself, the turning effort by one hand having to overcome the forward effort by the other.

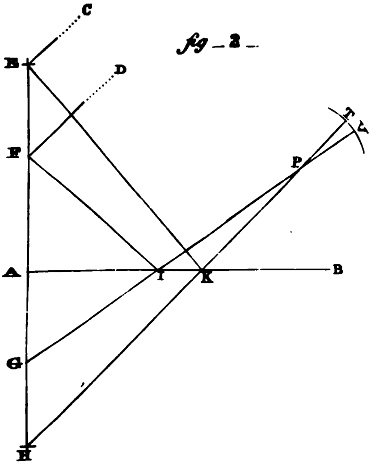
DRY ROT.—This is the result of a species of galvanic circulation: the wood has its rarer elements forced out, as are those of the solution in the trough ; hence the decomposed wood, when in the fire, produces so little flame. The loss of elementary matter, promoted by humidity and the immediately surrounding air, is succeeded by an influx of the medium of space, which renders the wood discontinuous and friable : as respects texture, the condition of the wood may be compared to bread into which water has entered. Long seasoning and the timber having been seasonably felled appear the natural preventive. Poisoning the wood is poisoning the workman at every accidental wound of the flesh.

Quicksilver let fall by drops in vacuo, each drop becomes concave in the rear of motion convex in the direction of motion, convex in front; and when impelled upwards, concave in the rear and convex on the opposite side, the concave rear in each instance appearing luminous. This may be an instance of sensible proof of the theory of motion. The drop parts with minus-pressure matter from the rear which is productive of the visual effect, and the medium of pressure acting more strongly on the impelled side forces the yielding drop into the twofold shape, concave and convex.

THE END.

P. PAYN, PRINTER.

fig _ 2 _



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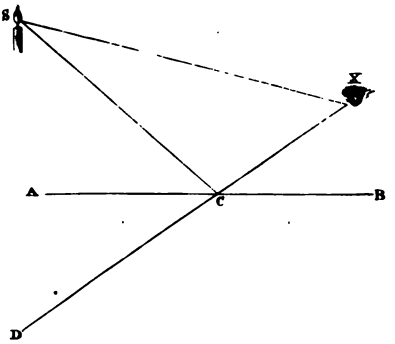

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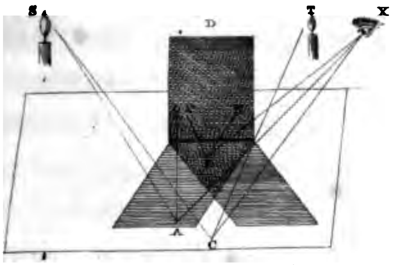

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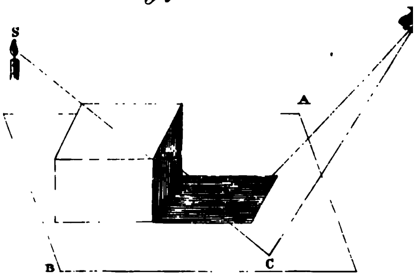

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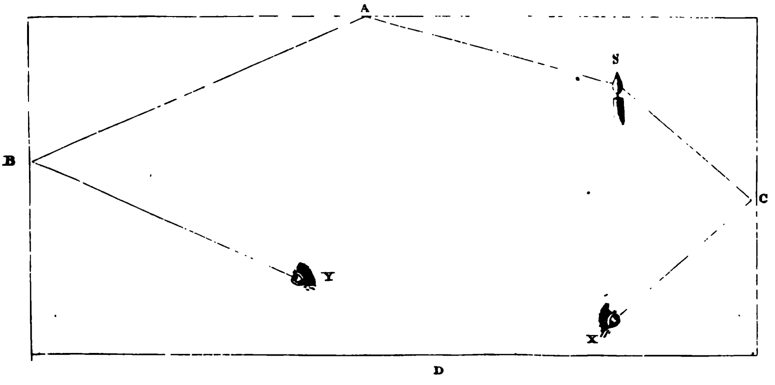

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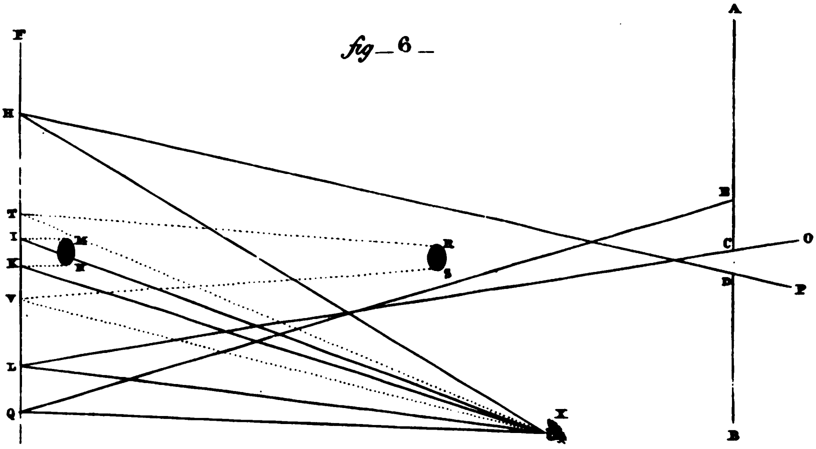

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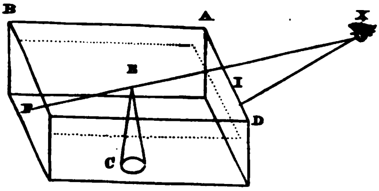

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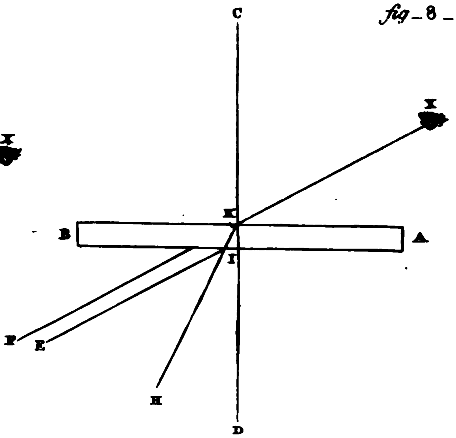

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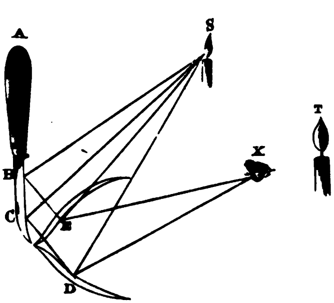

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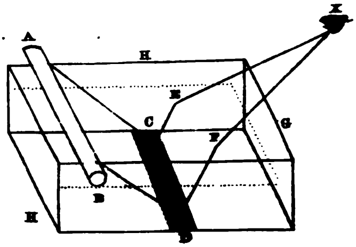


Plate 3.

fig. 11

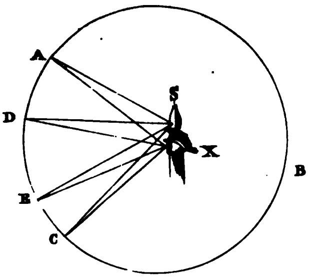


fig. 12

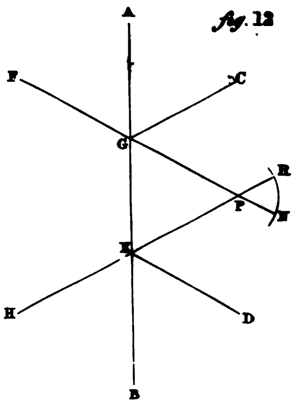


fig. 13

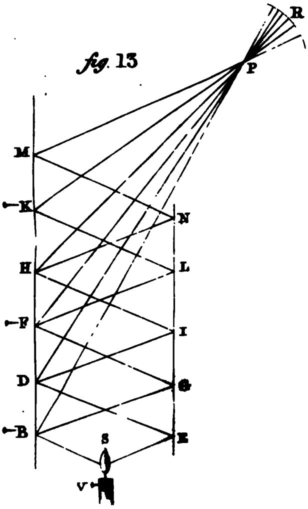
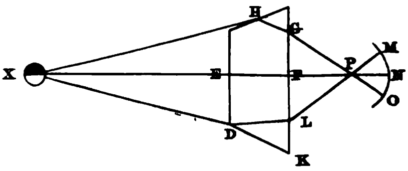


fig. 14



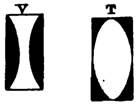


fig. 15

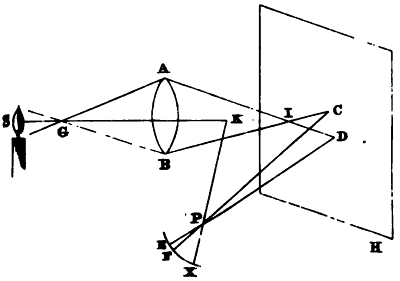
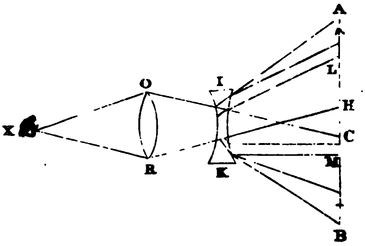


fig. 16



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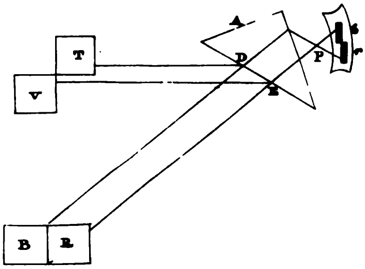

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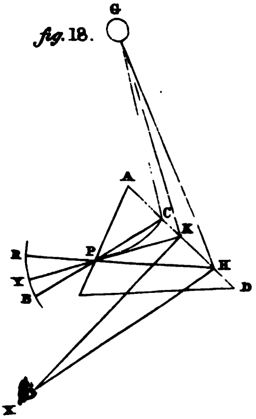

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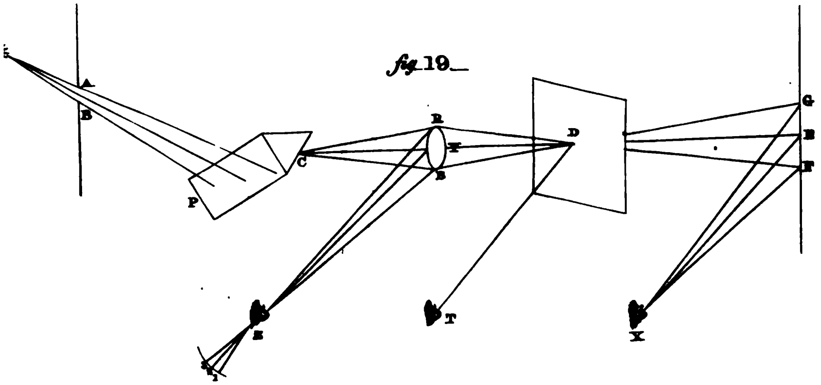

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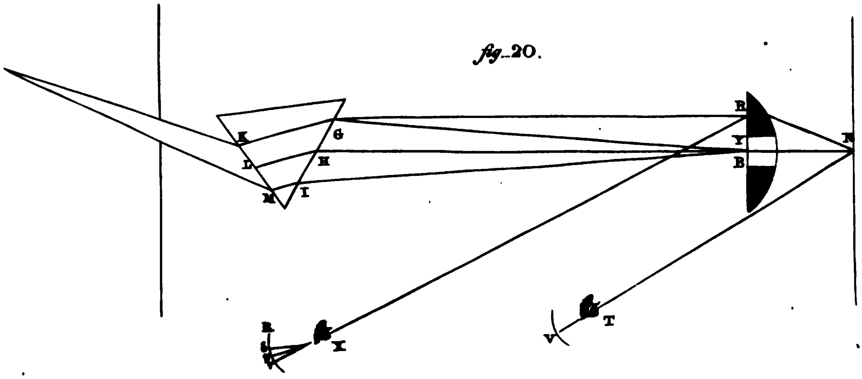

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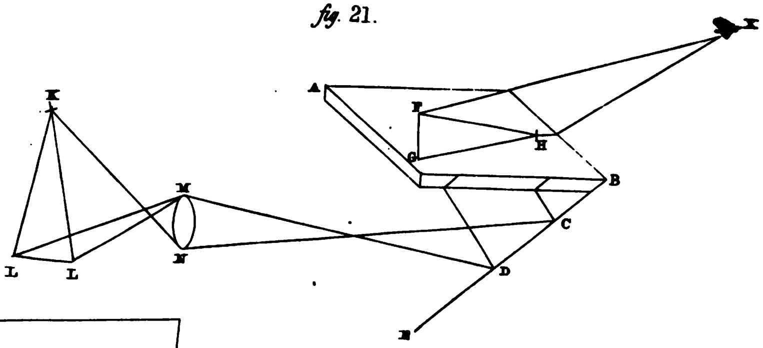

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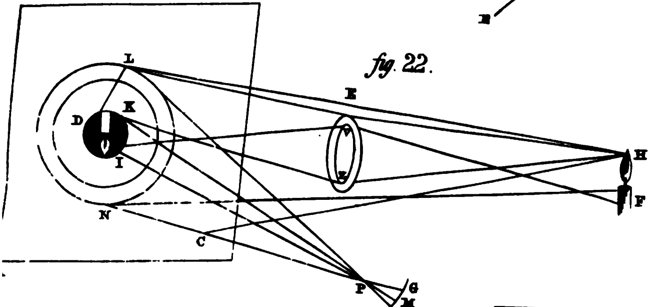

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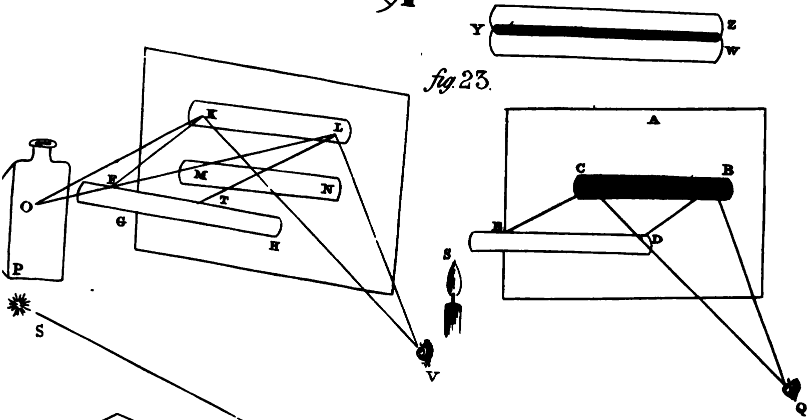


fig. 24

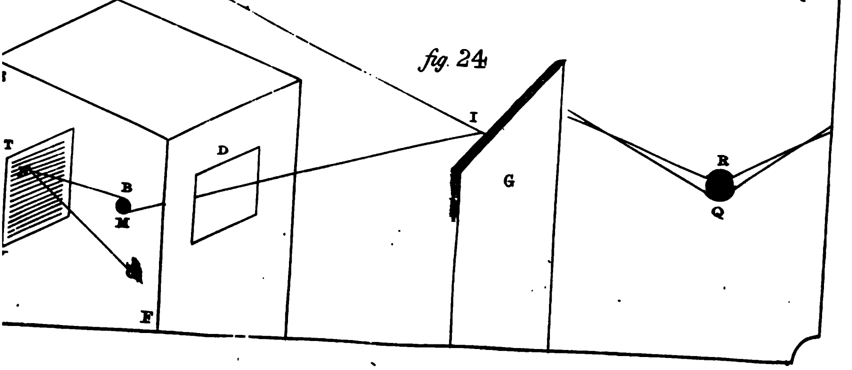


Plate 6.

fig. 25.

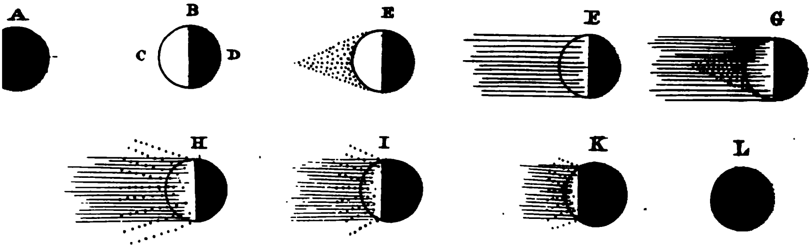


fig. 26.

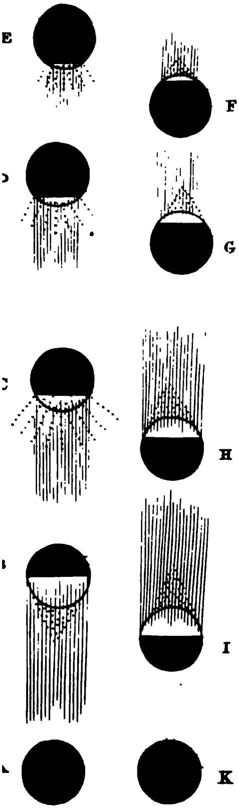


fig. 27.

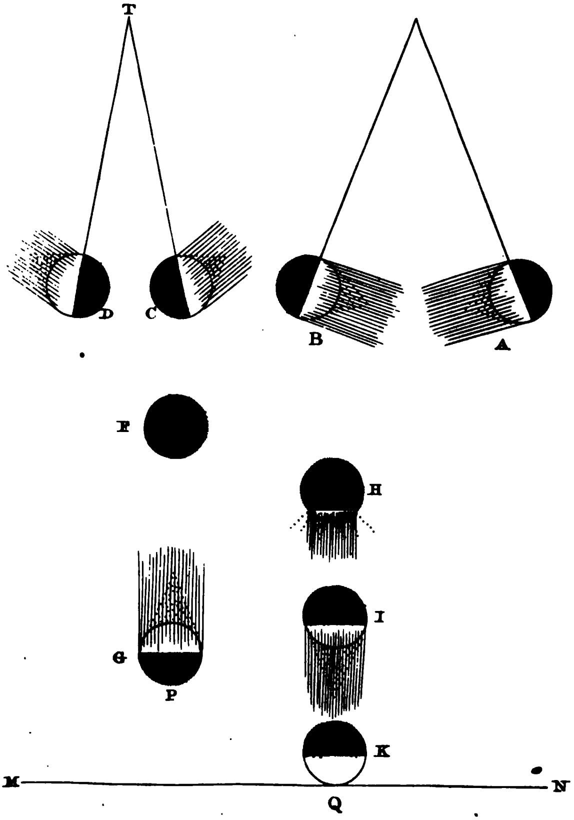


Plate 7.

fig. 28.

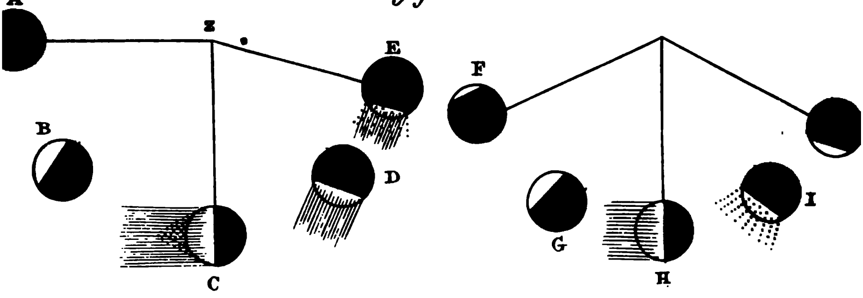
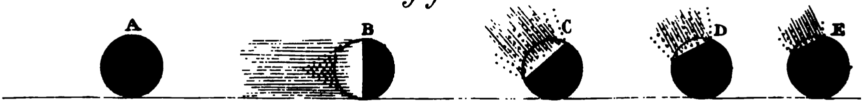


fig. 29.



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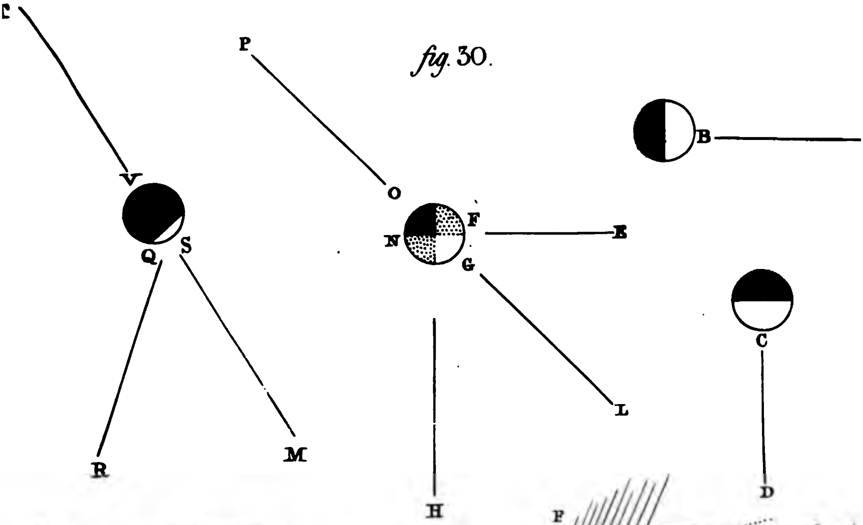


fig. 31.

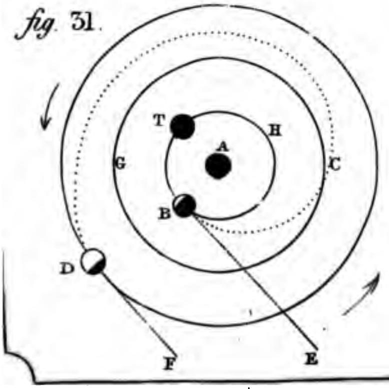
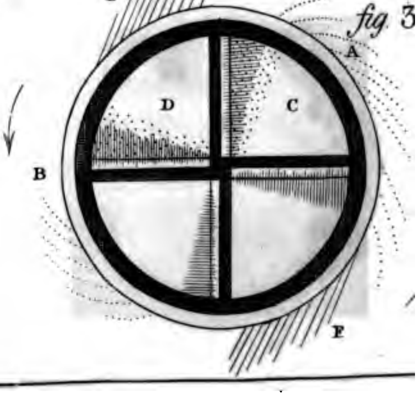
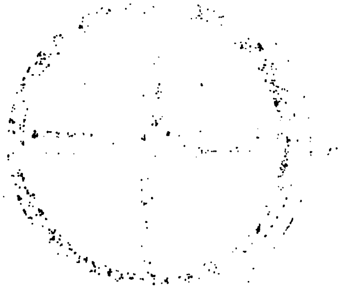


fig. 3





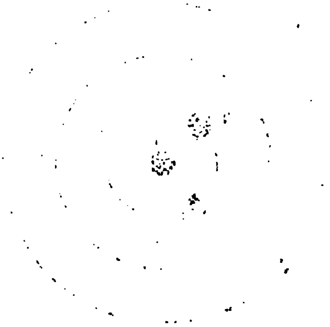


fig. 33.